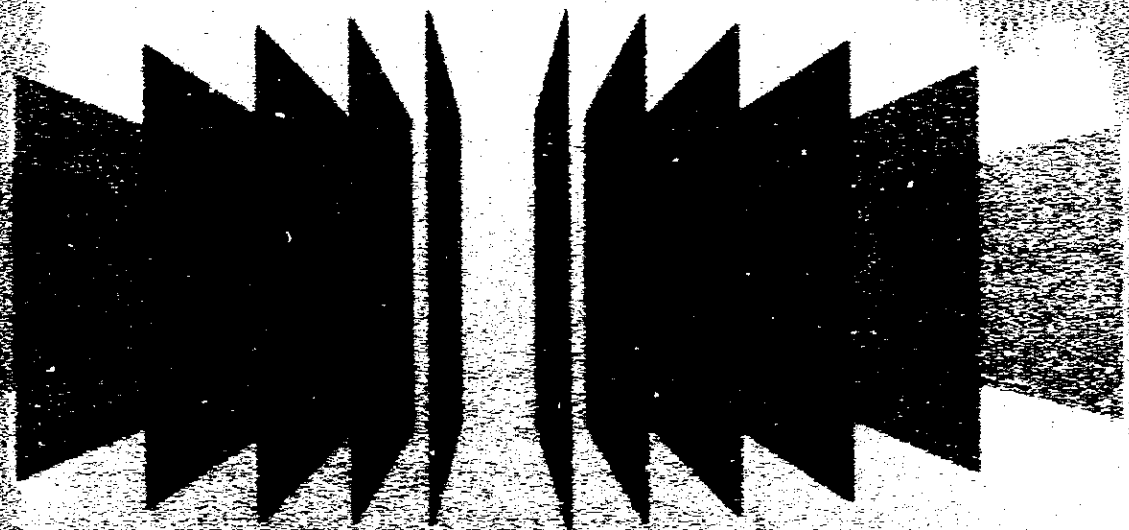
社会開発協力部報告書

NO. 67

THE STUDY OF THE GUAYAQUIL CITY URBAN TRANSPORTATION PLAN IN THE REPUBLIC OF ECUADOR



FINAL REPORT

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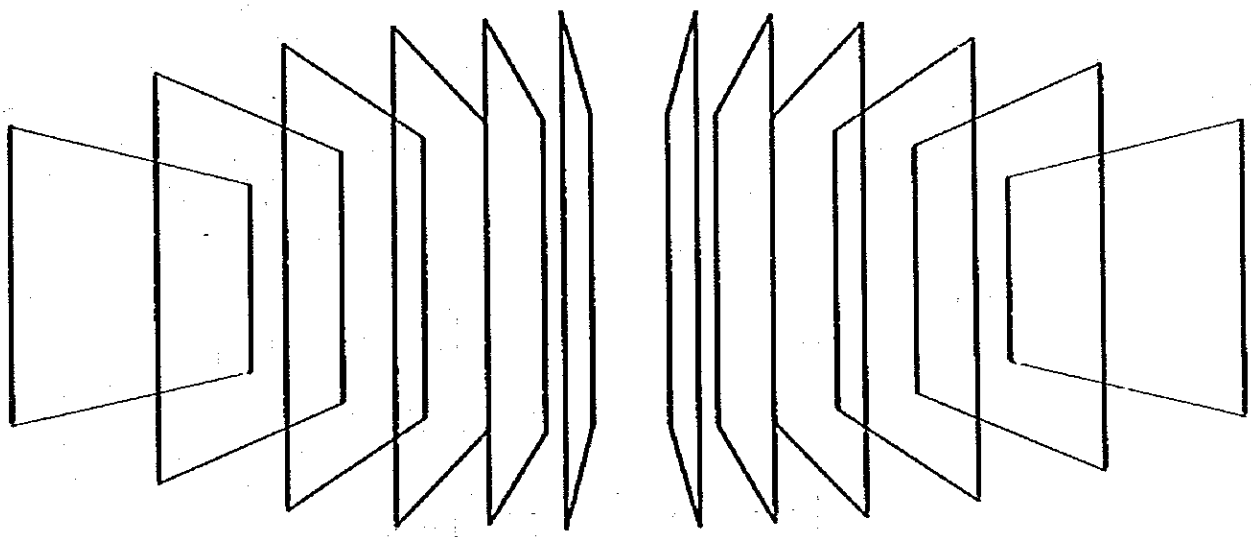
THE STUDY
OF
THE GUAYAQUIL CITY
URBAN TRANSPORTATION PLAN
IN
THE REPUBLIC OF ECUADOR



FINAL REPORT

AUGUST, 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Republic of Ecuador, the Government of Japan decided to conduct a study on The Guayaquil City Urban Transportation Plan and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Ecuador a study team headed by Dr. Kaoru Ichihara from April 1982 to February 1983 under the guidance of the Supervisory Committee chaired by Dr. Yoshiji Matsumoto, Professor of the University of Tokyo.

The team held discussions with the officials concerned of the Government of Ecuador on the Plan and conducted a field survey in Ecuador. Subsequently, further studies were made in Japan and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

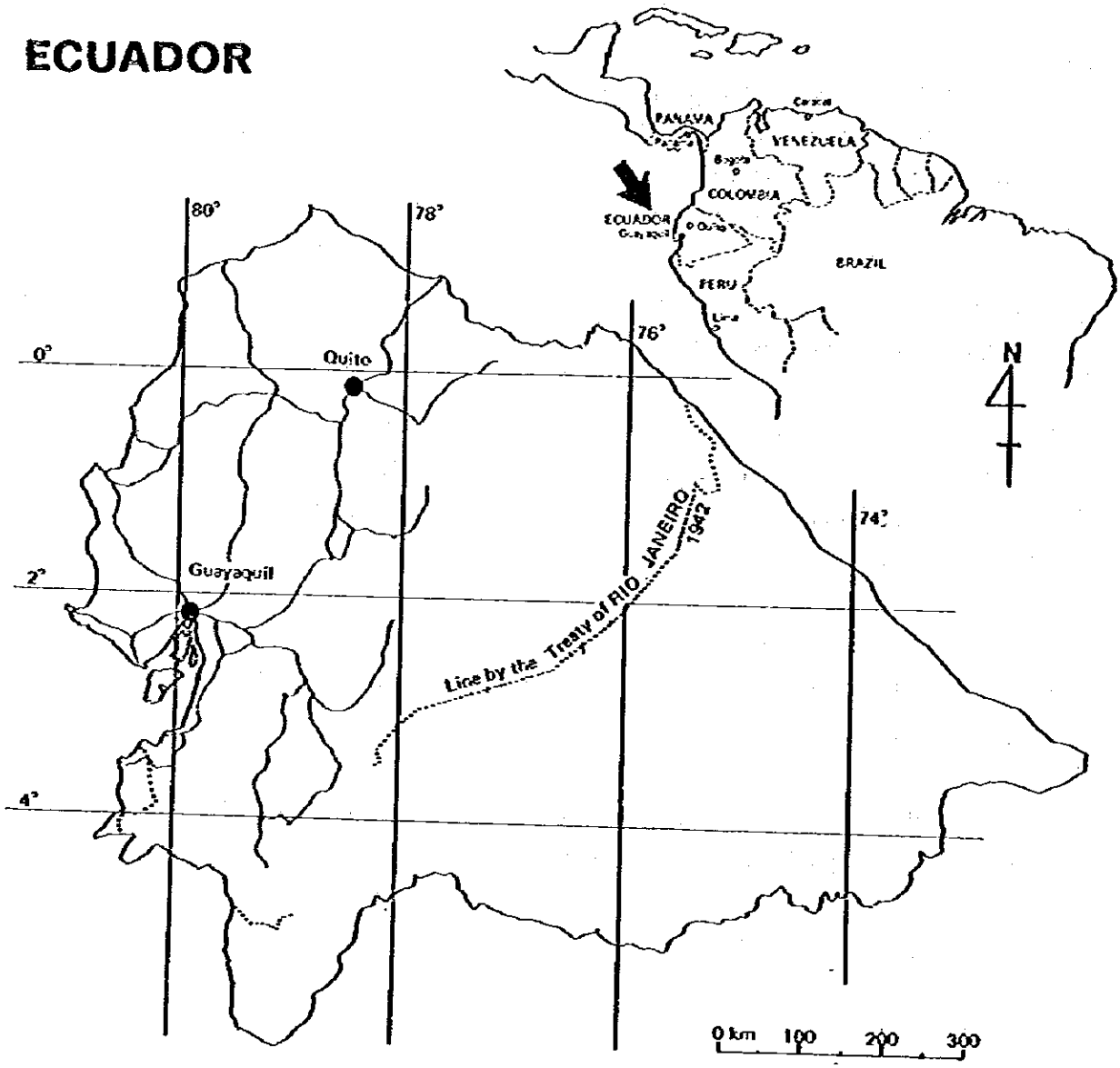
I wish to express my deep appreciation to the officials concerned of the Government of Ecuador for their close cooperation extended to the team.

August, 1983

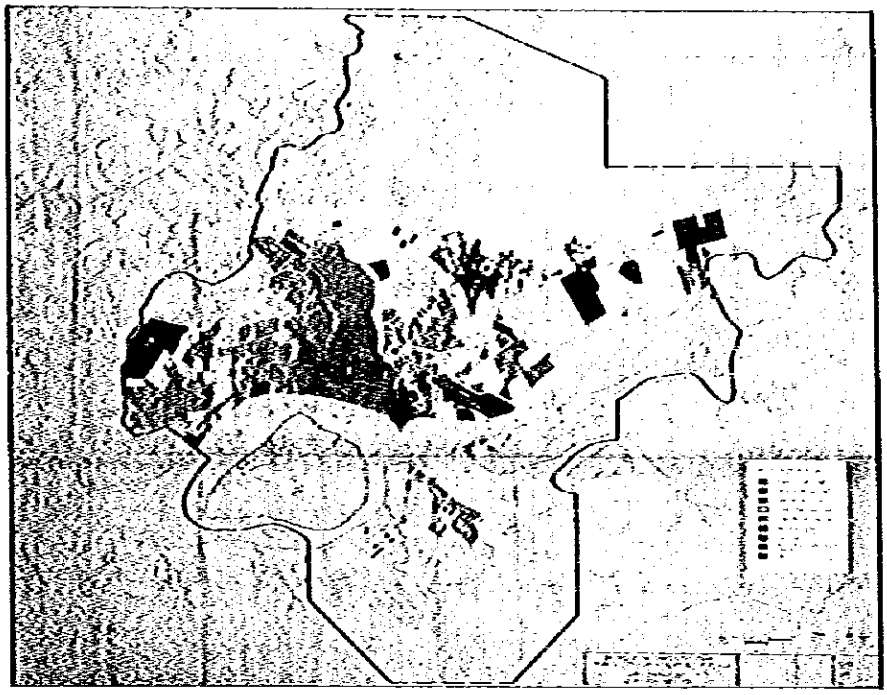
Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

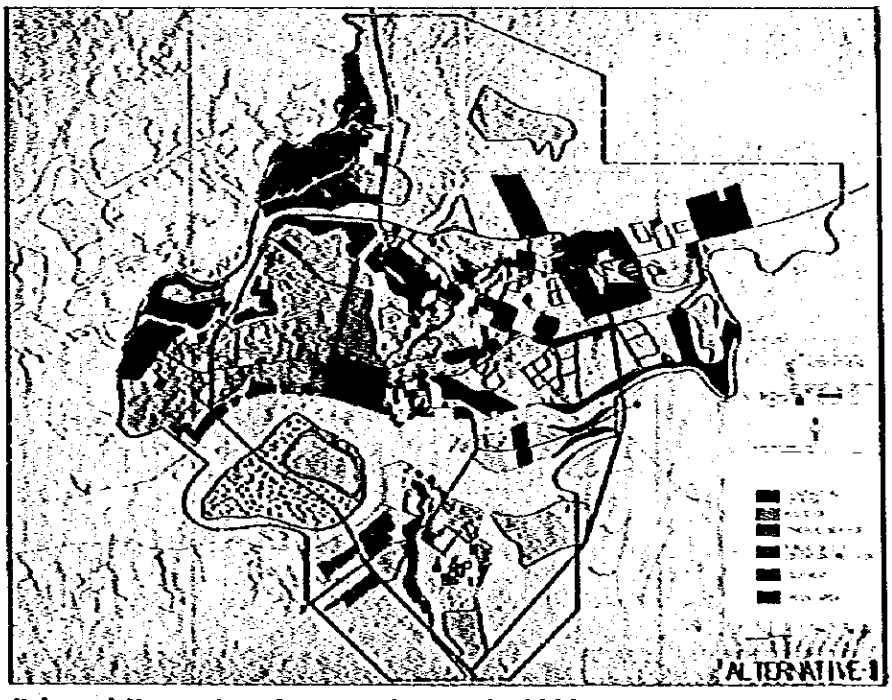
ECUADOR



Area	:	270,670 Km² (after 1942)
Population & Growth Rate	:	8,945,000 (1982), 3.43%/year (74–82)
Gross Domestic Products	:	11,400 Mil. US$ (1980, 24.95 S/$, official rate)
GDP per Capita	:	1,365 US $ (1980)
Productive Structure	:	Agriculture 18.6%, Mine & Manufacture 32.3%, Services, etc. 49.1% (1979)
International Trade	:	Export 1,557 M.US$/Import 1,325 Balance 232 M.US$ (1978)
National Budget of Government	:	2,038 M.US$ (1981, 24.95 S/$)
Index of Consumer's Prices	:	12.6%/year (1980), 13.4 (81)
Foreign Money Exchange Rate	:	US 1 $ = 33 Sucres in official/50 S. in free market (June, 1982)



Existing Conditions of Land Use



Selected Future Development Pattern in 2000
(Alternative–III : Linear Development Type toward the northern area)

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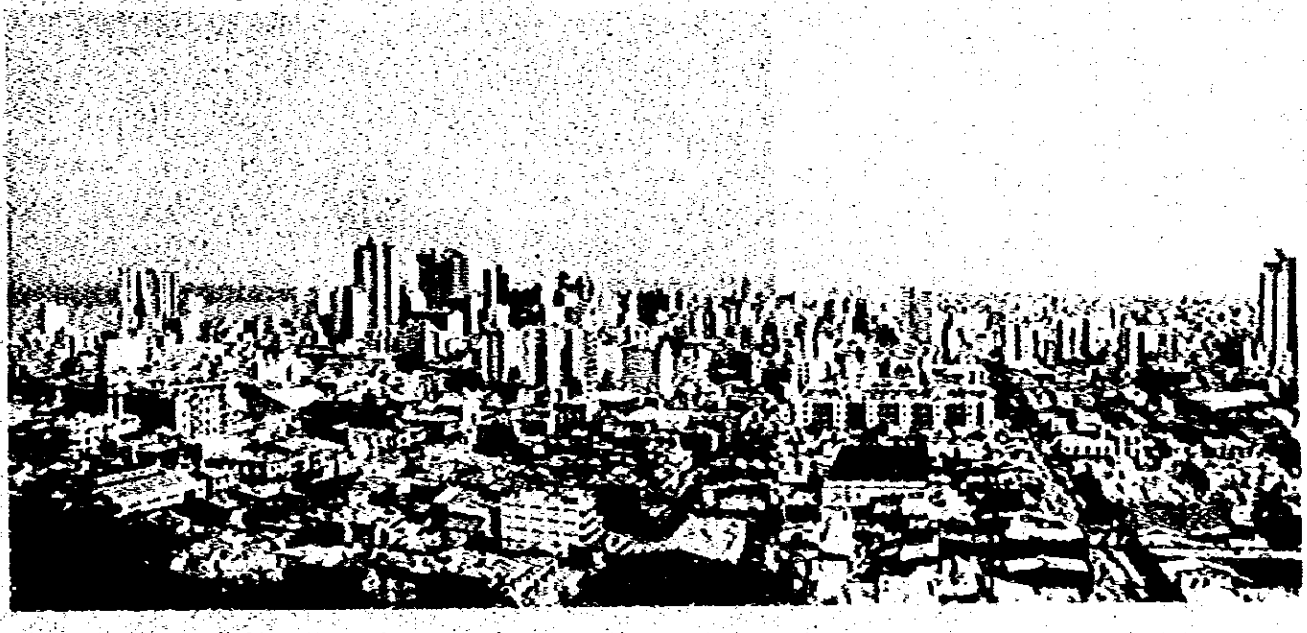
CONCLUSION AND RECOMMENDATION



GENERAL SITUATION AND STUDY OBJECTIVE

Due to the intensive economic development and population increase, and in addition, to the very unique geographical configuration of the urban area, Guayaquil city is already confronted with various urban transport problems such as traffic congestion all day long in the central area, bottlenecks around the central area from each direction, insufficient supply of public transport to meet the demand, etc.

Since the present urban area has high density population, room for new settlement and industrial activities in the future is now being sought mainly in the vast plain left undeveloped in the northern area.

In view of the existing transport problems and to cope with foreseeable future developments, it is imperative for the city that development of the urban transport system be urgently carried out. The objective of the Study, therefore, is to formulate the plan for the urban transport system in Guayaquil, prepare possible solutions and propose their implementation programs under the selected land development pattern in the year 2000. The Study presents its results in two plans:

1. Long-term transportation plan (master plan) which targets the year 2000.
2. Short-term improvement plan which utilizes and develop the existing transport facilities most effectively.

CONCLUSION AND RECOMMENDATION

CONCLUSION

(1) Long-term Transportation Plan

Combination plans of the road network and MRT (Mass Rapid Transportation System) plan will be an essential condition to solve the present congestion, meet the numerous traffic demands in the future and compose the basic axes for the urban development targetted.

In addition to the combination plans, the proposed improvement plan of bus transport and its coordination with MRT will be also essential to maximize the effect of the plans.

a. Proposed Road Network

The proposed road network, which developed on-going projects by MOP (Ministerio de Obras Publicas) and the Municipality of Guayaquil, is fundamentally composed of a ring and radial system, and it purposes to solve the bottlenecks around the central area, distribute the traffic concentration in the central area and promote the development of the northern area, by the basic form shown in Figure -1 (page at 3).

The target and priority of the major projects in the proposed road network are recommended as shown in Table-1 (page at 5).

On executing these projects, prudent considerations should be paid so as to produce the most satisfactory results in coordination with the stages of MRT route construction.

b. MRT Plan

The MRT plan is composed of two basic lines (see Figure 2, page at 4), corresponding to the main traffic routes which extend to the four directions from CBD (Central Business District: Casco Central). It purposes to absorb the road traffic dramatically, improve and activate the public transport system in coordination with buses, and give an important push to promote the desired urban development. As the result of careful examination of several combinations in the route alignment, the target and priority of implementation are recommended as shown in Table -2 (page at 5).

As for the alternative MRT systems, any of four systems (Urban Railway, Light Rail Transit (LRT), Monorail and Rubber Tyre Type Railway) except Subway will produce benefits over its cost, and Urban Railway is the most promising in cheap investment, large transport capacity, ease in maintenance, flexibility to cope with more demand in the future, etc.

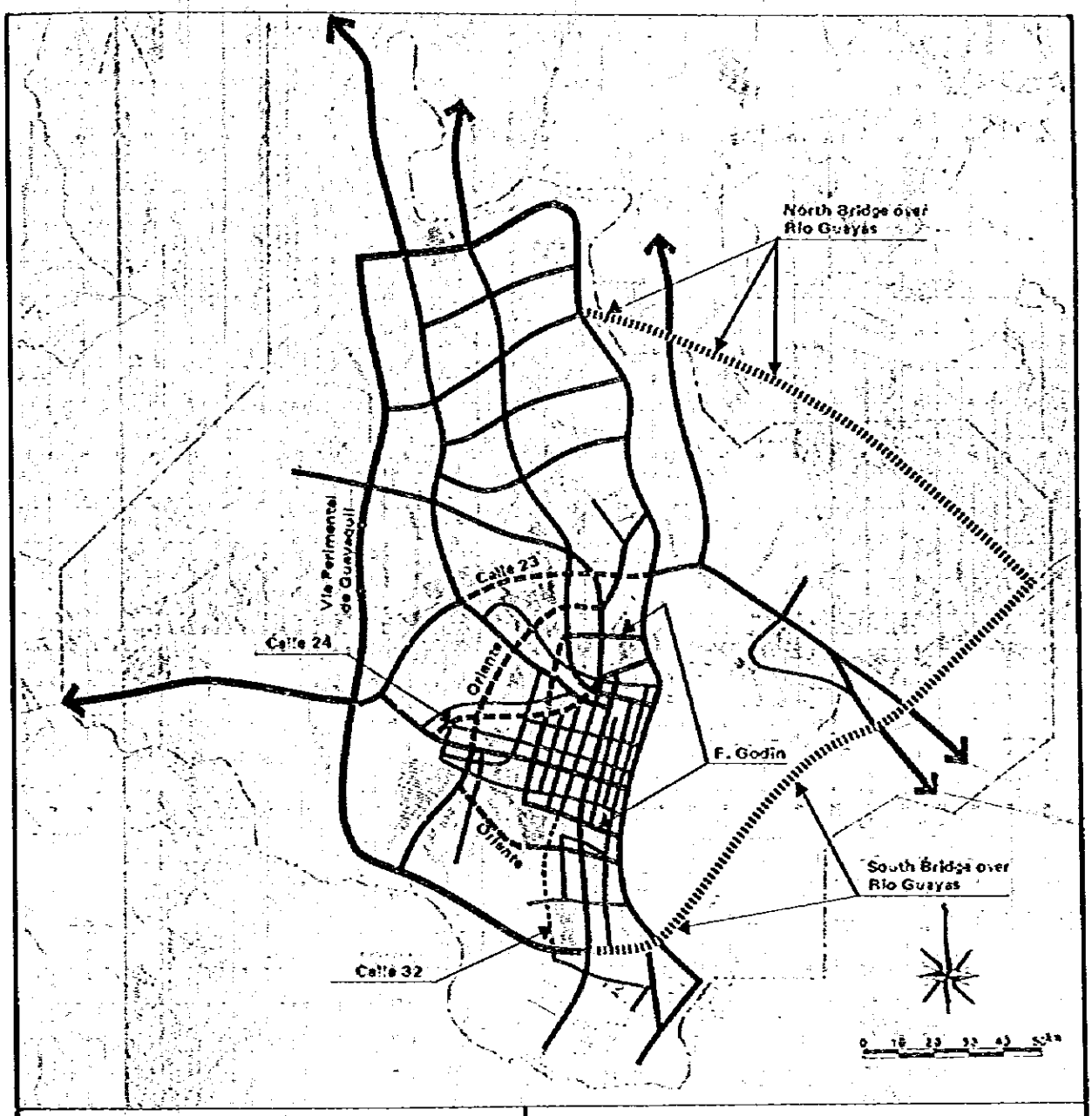


Figure -1 PROPOSED ROAD NETWORK

	PROPOSED ROAD
PRIMARY DISTRIBUTOR	
DISTRICT DISTRIBUTOR	
LOCAL DISTRIBUTOR	

THE STUDY OF THE GUAYAQUIL CITY URBAN TRANSPORTATION PLAN

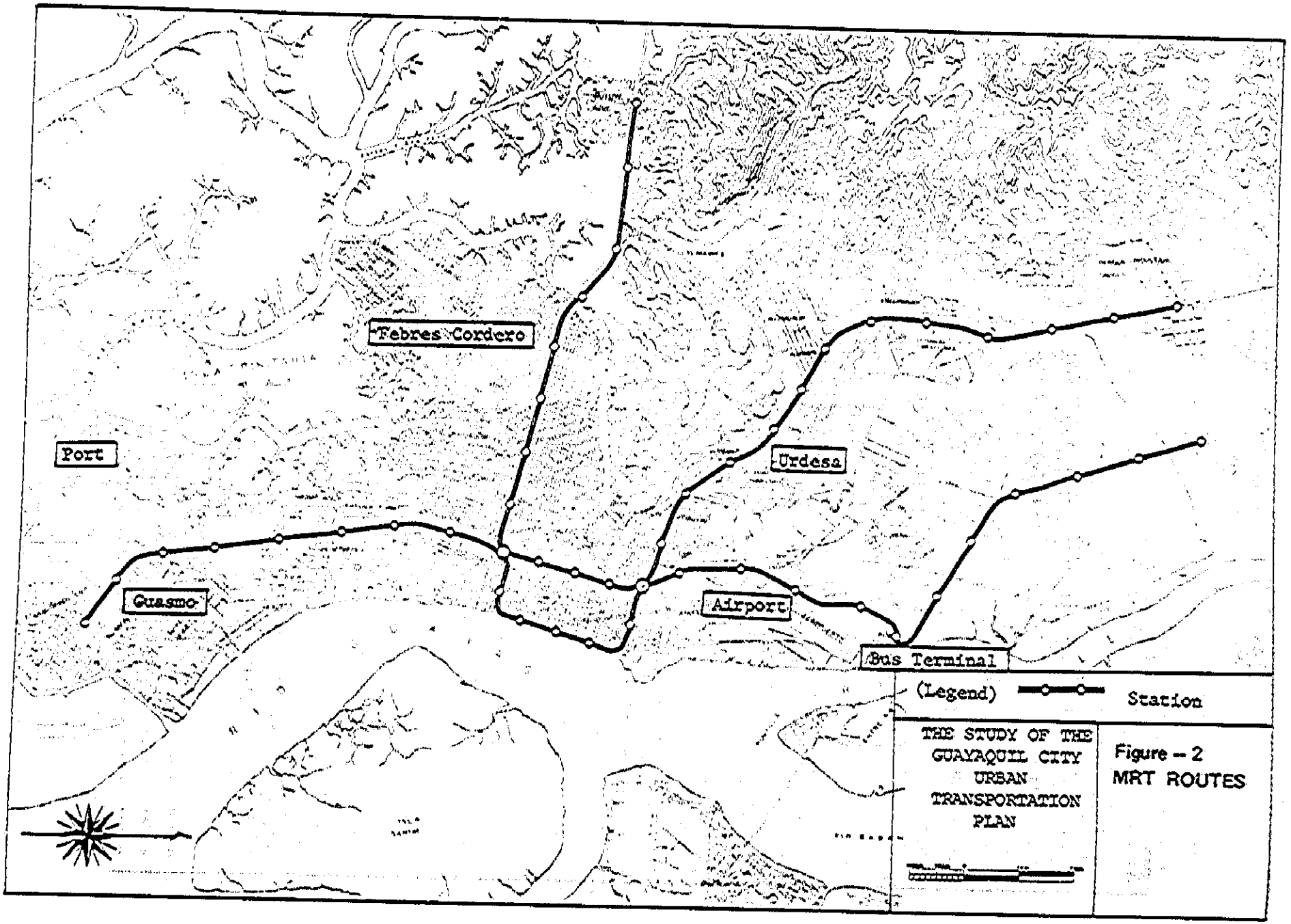

Febres Cordero
Port
Urdesa
Guasmo
Airport
Bus Terminal
(Legend)
Station
THE STUDY OF THE GUAYAQUIL CITY URBAN TRANSPORTATION PLAN
Figure – 2
MRT ROUTES

Table -1 TARGET AND PRIORITY OF MAJOR PROJECTS IN PROPOSED ROAD PLAN

Billion ($x10^9$) sucres in 1982 Prices

Priority	Target	Major projects	Work volume	Rough estimate
1-1	Intensive connection between northern area and CBD	a. Large-scale improvement of intersections by grade separation toward the north	6 places	1.1
		b. Construction and improvement of ring roads within urban area, Calle F. Godin & Oriente	17.8 km	
1-2	Development of northern area and intensive connection between Pascuales and Duran	a. Extension of Via Perimetral de Guayaquil (outer ring road)	22.8 km	7.0
		b. North bridge over Rio Guayas		
2	Improvement of the area around CBD and intensive connection with western area	a. Large-scaled improvement of intersections by grade separation	9 places	2.0
		b. Improvement of radial roads (Calle 23, 24 and 32)	12.4 km	
		c. Tunnel under Cello el Carron	1.3 km	
3	Development of southern area and connection of CBD with southern area and Duran	a. Extension of Via Perimetral de Guayaquil	17.5 km	10.6
		b. South bridge over Rio Guayas		
		c. Improvement of Intersections by grade separation	2 places	
Total		Intersections Road projects	17 places 71.8 km	20.9

Table -2 TARGET AND PRIORITY OF MRT PROJECTS

Billion ($x10^9$) Sucres in 1982 prices

Priority	Main targets	Route and Section	Length	Rough estimate
1	Establishment of the urban axis and augmentation of transport capacity in north-south direction	Urban section of North-South route from Bus Terminal to the entrance Guasmo through Av. Quito	13.5 km 15 stations	8.1
2	Mass rapid transport in the urban area, establishment of the urban axis toward the west	Urban section of East-West route, from Portete bridge, through Portete, S. Bolivar to Urdesa	14.5 km 16 stations	11.9
3	Improvement of public transport system in the whole area	The rest section of the whole route	23.0 km 20 stations	8.2
Total			51.0 km 51 stations	28.2

Note) 1 US dollar = 50 sucres (average in 1982)

c. Improvement of Bus Transport and Coordination with MRT

In order to maximize the effects of the above road and MRT plans and to confirm a comprehensive urban transport system, the bus transport which plays very important role in daily traffic is requested to be improved according to the following items:

1. Basic improvement such as increase of transport capacity, augmentation of suppliers, etc.
2. Coordination of bus route with MRT
3. Improvement of public transport system and traffic management in CBD

d. Implementation Program

d-1. Phasing plan of projects implementation

The following implementation program up to 2000 was formulated based on considerations and comparison between project costs and conventional financial sources applicable to transport infrastructure in the Study Area.

Phase-1

1983 - 85 : Preparatory work of phase-2 projects, the half of on-going road projects by MOP and Municipality.

Phase-2

1986 - 90 : 1st-priority projects of both the road and MRT in the long-term transportation plan.

Note):

Examination of Long-term Transportation Plan at Phase-2 Stage in 1990:

Effectiveness of the long-term transportation plan at the end of this phase-2 stage in 1990 was examined from the engineering and economic aspects, and proved not only to be very useful to meet the traffic demand in 1990 and confirm the urban structual axis toward the northern area, but also to be quite important to realize the final goals of the long-term plan steadily.

Phase-3

1991 - 95 : 2nd-priority projects of the road and MRT in the long-term, the rest half of on-going road projects.

Phase-4

1996 - 2000: Final projects of the road and MRT in the long-term plan.

d-2. Perspective for financial sources applicable to projects

It is possible to draw the following perspective although the projection was based on unconfirmed factors:

1. If the growth rate of 6.5%/year in national economy set by the National Development Plan (1980-84) shall continue up to 2000, the conventional financial sources applicable to transport infrastructure in the Study Area shall be able to cover the whole road project cost and 2/3 of the MRT cost.

2. If the growth rate in national economy decreases to 5.0%/year, it shall cover also the whole road project cost but only 1/3 of the MRT cost.

(2) Short-term Improvement Plan

The policy of the short-term improvement plan is to make full use of the present traffic and transport system, giving careful consideration in coordinating the short-term programs with the long-term transportation plan.

The following measures should be put into an early action effectively:

a. Traffic Engineering and Management

1. Improvement of intersections

2. Improvement of separators

3. Installation of traffic signals and introduction of control system for them

4. Limiting road side parking and construction of off-street parking lots

5. Other improvements

b. Bus Transport

Many subjects ranging over users' problems, suppliers' and administrative aspect, were grouped into the following programs. These measures also should be put into an early action effectively.

1. Early action programs

Improvement of bus routes, bus fleets, bus stops, etc., establishment of bus lanes on wide roads, improvement of suppliers' organizations.

2. Re-organization of inter-regional routes after the completion of the Bus Terminal

c. Implementation Program

1. Phasing plan of measures implementation

Phasing plans to execute measures above-mentioned are shown in Figure -3 (page at 9) for the traffic engineering and management, and Figure -4 (page at 10) for the bus transport.

2. As for the implementation of the short-term improvement plan, it is recommendable to be executed mainly by C.T.G. and its budget in the same way as it has been done so far.

Figure -3 IMPLEMENTATION PROGRAM FOR TRAFFIC ENGINEERING AND MANAGEMENT

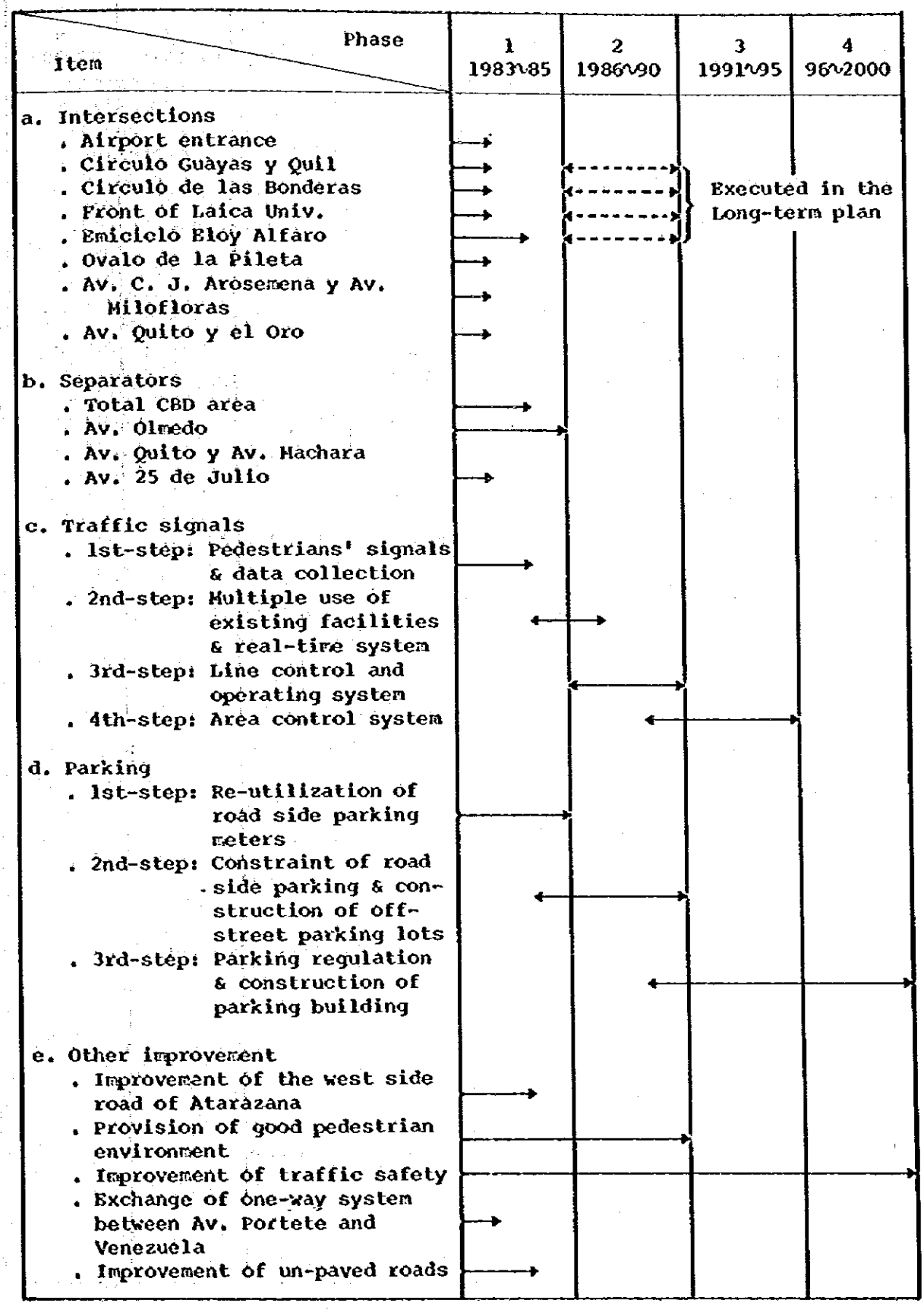
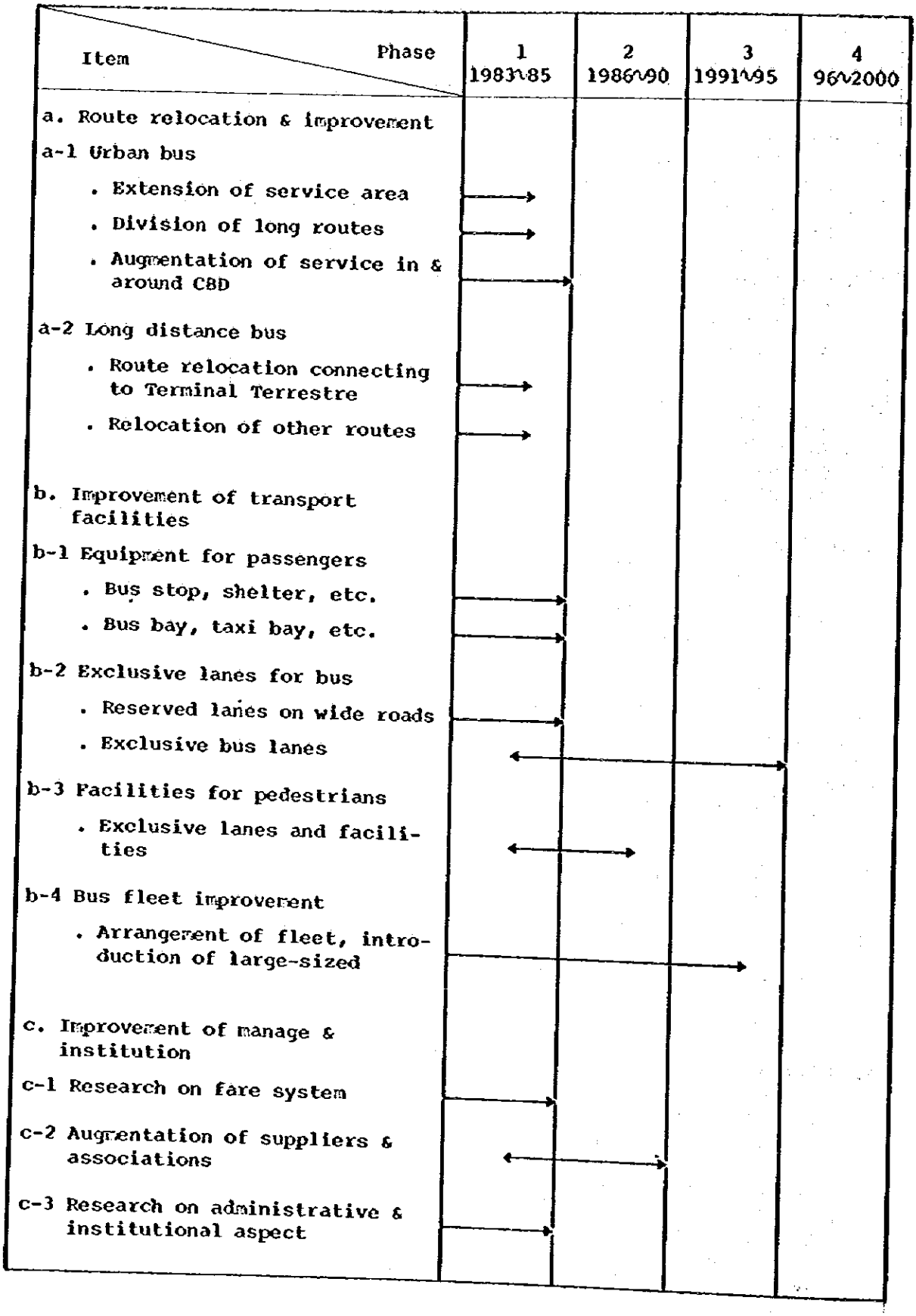


Figure -4 IMPLEMENTATION PROGRAM FOR BUS TRANSPORT IMPROVEMENT



RECOMMENDATION

The proposed master plan (Long-term transportation plan) would be essentially effective for solving the transport problems in this urban area and promising its long-term development for better urban activities. It would be recommended that the plan be put into action as early as possible. At executing the plan, related projects should be prepared so that they might perform their purposes most effectively not only by each project separately but also by their combination.

In order to make it easy to achieve the final target toward the 2000 year, the policy of mid-term implementation in 1990 should be set to establish an urban structural axis along the main traffic route in the north-south direction, and construction of the MRT and improvement of the roads along this axis would be an indispensable first step to attain the goals in a short period.

Last, for the major projects identified in the master plan, their feasibility should be examined further in detail and immediately since the plan was confirmed based on rather simplified methods.

CHAPTER 1. INTRODUCTION

Chapter 1 INTRODUCTION

1-1 BACKGROUND SITUATION

Guayaquil, the capital city of the Province of Guayas, has been the most prosperous city in business, commerce and industry with the biggest population in the Republic of Ecuador. Its population is supposed to be about 1,200,000 in 1981 and increase ratio is estimated 4.4% per annum for more than 10 years from now.

Since the city is located in a plain area brought about by Rio Guayas, the configuration of the present urban area and development of the city in future are closely related to the layout of Rio Guayas and its branch streams.

The present urban area of the city is formed up in a comparatively narrow range which is located almost in the central part of the plain area, and the city center is positioned in the northeastern corner of the city with the stream of Rio Guayas in the backward. Therefore, traffic flow in the city is concentrated from the 3 directions of the south, west and north of the city, and traffic volume increases as approaching closer to the city center. Since the present urban area of the city has already been inhabited with the high density, the room for new settlement of the urban population and inudustrial activities in the future is now being sought mainly for in the southern suburban area as well as in the vast plain left undeveloped in the northern suburban area of the city.

Such being the case, the orientation of complete provision of urban transport facilities shall be recognized as follow:

1) For the time being, it should be tried to alleviate the existing traffic congestion in the central area due to concentration of the traffic flow from the 3 directions mentioned-above.

2) In the long-term, it should be tried to cope with the development and push it forward in both the north and south suburban areas where the future development is targetted.

1-2 STUDY OBJECTIVE

The objective of the Study, therefore, is to formulate an urban transportation plan for the Guayaquil City in order to cope with the existing urban transportation problems and the future traffic demand.

The urban transportation plan consists mainly of an urban transportation system and its network plan (Long-term transportation plan). Its purpose is to alleviate forecast traffic congestion along the main traffic routes and promote the development in the north and south suburban areas.

In the process of formulating the Long-term transportation plan, a traffic improvement plan (Short-term improvement plan) to ease the present congestion in the central area of the city through efficient utilization of the existing transport facilities is also worked out.

1-3 STUDY AREA

The Study covers the Guayaquil urban area including Duran and Pascuales for the Long-term transportation plan, and the central area of the Guayaquil for the Short-term improvement plan. Figure 1-3.1 shows the whole Study Area.

1-4 STUDY APPROACH

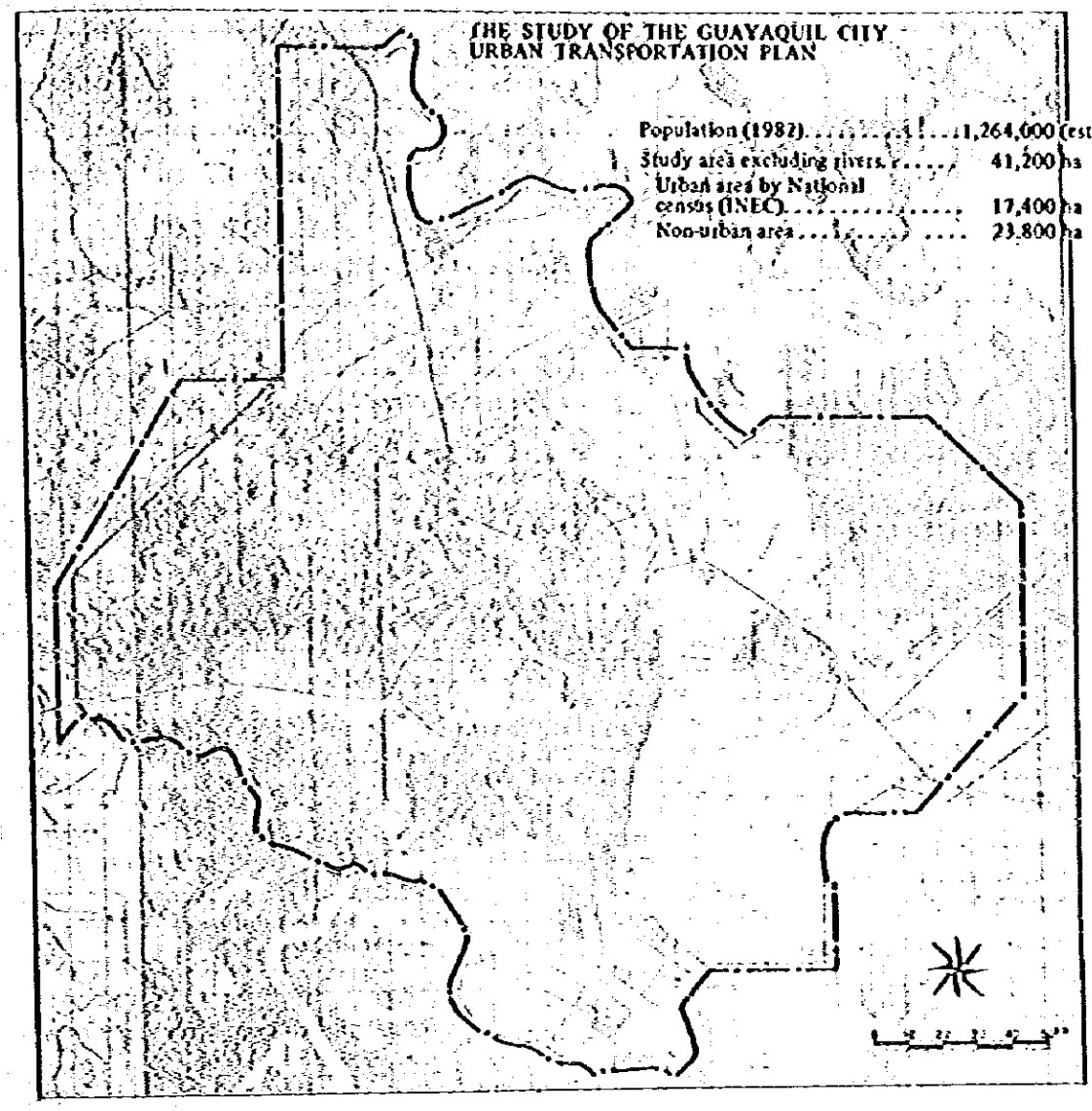
The method of the Study approach is outlined in Figure 1-4.1 by each staging, and the procedure of the Study is shown in Figure 1-5.1.

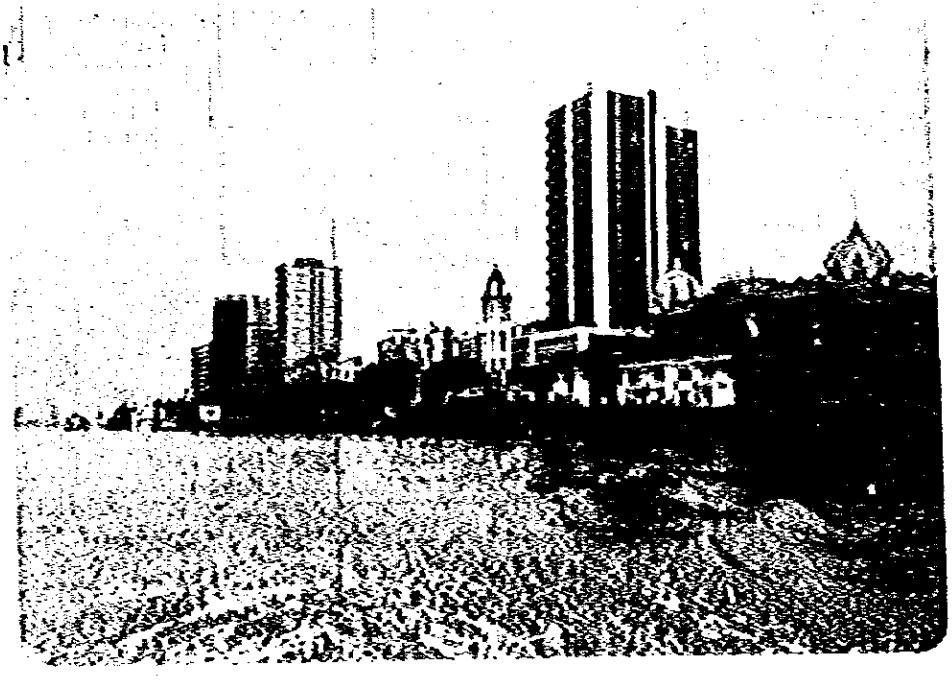
The recommendations and proposals of the Study are grouped in the following two plans:

1) Short-term Improvement plan

It is worked out in such a way as helps alleviate traffic congestion in the area involved by making maximum use of the existing transport facilities without major capital investment.

Figure 1-3-1 STUDY AREA

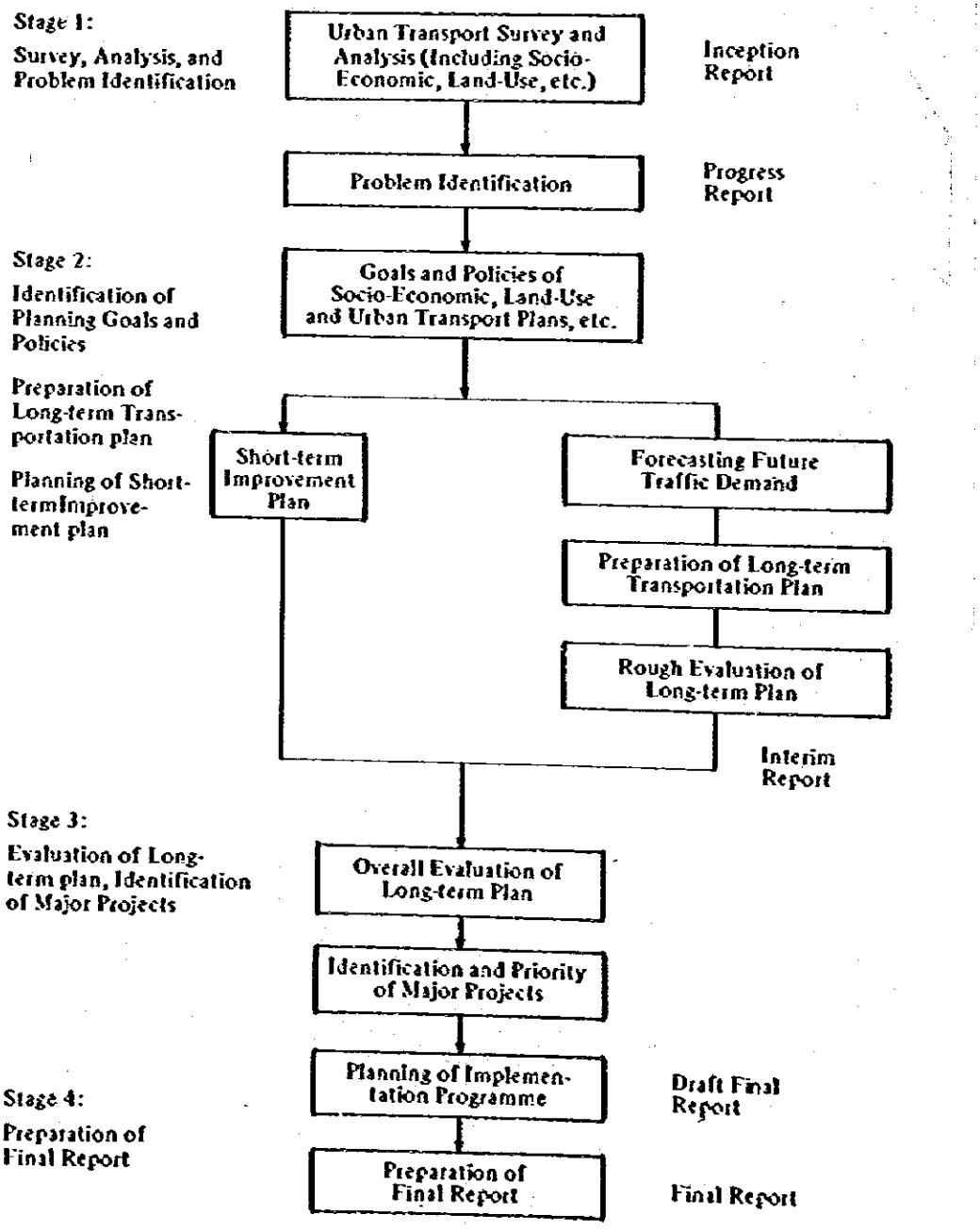




2) Long-term Transportation Plan

It is concerned with comprehensive structual planning to solve the foreseeable traffic problems in the target year (2,000) mainly by orderly arrangements of a road network, and introduction of MRT (Mass Rapid Transportation) for main traffic routes. Major projects are identified and ranked toward the target year in the Long-term transportation plan.

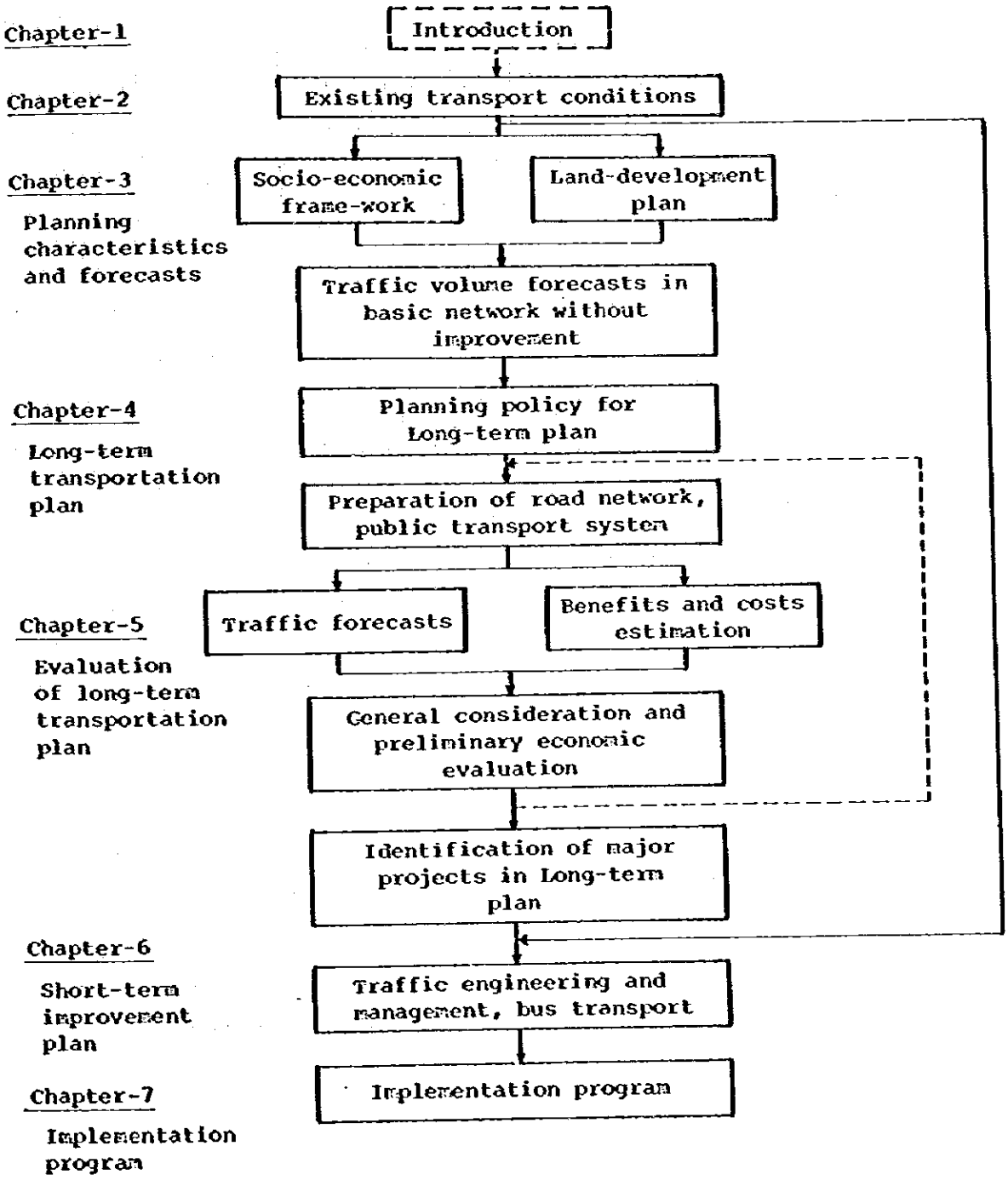
Figure 1-4.1 STUDY APPROACH BY STAGING



1-5 ARRANGEMENT OF THIS REPORT

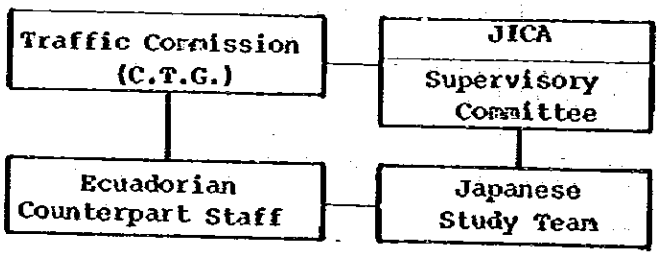
The arrangement and contents of this report are given in Figure 1-5.1.

Figure 1-5.1 STUDY PROCEDURE AND ARRANGEMENT OF THIS REPORT



1-6 STUDY ORGANIZATION

The Study was carried out by JICA (Japan International Cooperation Agency) in close cooperation with the Traffic Commission (C.T.G. Comision de Transito del Guayas) that is in charge of the Study under the Government of Ecuador, in coordination with other related agencies. It started in April, 1982 and terminated in July, 1983. The Study organization and its members are as follows:



1) Traffic Commission of the Province of Guayas

1. Dr. Gustavo Noboa Bejarano
   (Predecessor, Mr. Juan Pablo Moncagata Pargas)
   Principal President/Governor, Province of Guayas

2. Dr. Dalton Bacigalupo Buenaventura
   (Predecessor, Dr. Carlos Estarellas Merino)
   President

3. Mr. Gustavo Ruiz Guzman
   Executive Director

4. Mr. Crnel. Carlos Noboa Baquerizo
   Sub-Executive Director

5. Mr. Arturo Cabrera Sotomayor
   Director, Technical Department

6. Mr. Flabio Maridueña
   Director, The Officials and Policemen School of Traffic Commission

2) Supervisory Committee, Government of Japan

1. Dr. Yoshiji Matsumoto
   Chairman of the Committee
   Professor, Tokyo University

2. Mr. Masahito Mizoguchi
   Ministry of Transportation

3. Mr. Tatsumi Yamamoto
   Ministry of Transportation

4. Mr. Shoichi Akita
   Ministry of Construction

5. Mr. Yoshio Amemiya
   (Predecessor, Mr. Sadao Inoue)
   Ministry of Construction

3) Study Team

3)-1 Japanese Expert

1.	Dr. Kaoru Ichihara	Project Manager Traffic Engineering and Management
2.	Mr. Etsutaro Iimuro	Sub Project Manager Transport Economy
3.	Mr. Yutaka Yamaguchi	Transport Planning
4.	Mr. Seiichiro Yamazaki	Transport Analysis, System Engineering
5.	Mr. Makoto Nakamura	Traffic Survey
6.	Mr. Tsuneyoshi Jitsuhara	Traffic Survey
7.	Mr. Hirotoshi Yamakawa	Public Transport Planning
8.	Mr. Kotaro Yamada	Railway Planning
9.	Mr. Takeshi Isaji	Road Planning
10.	Mr. Yoshinao Sawahata	Land Use Planning
11.	Mr. Keiichi Ichikawa	Traffic Control Planning

3)-2 Ecuadorian Counterpart

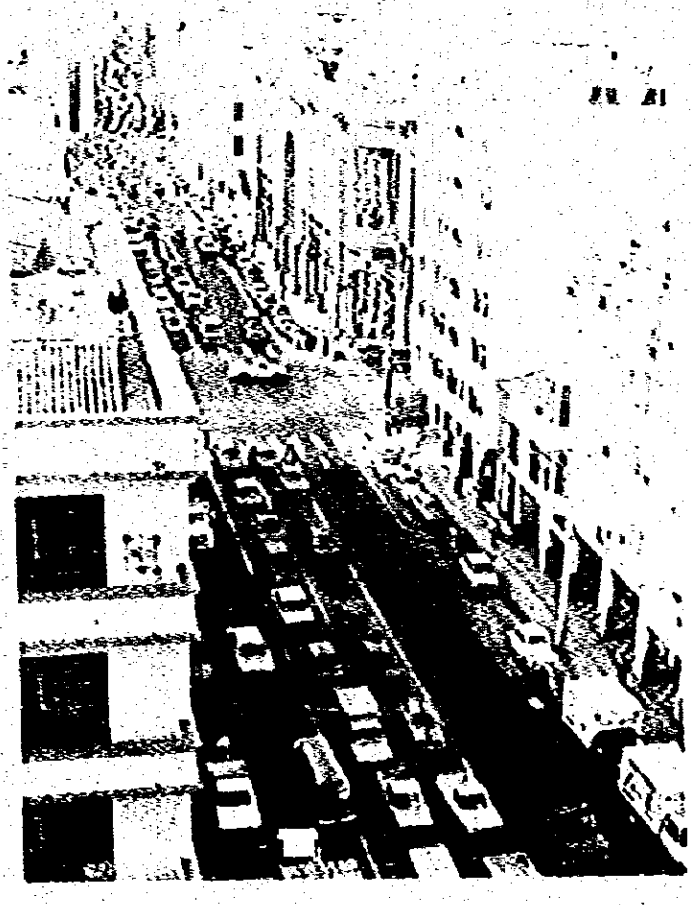
1. Mr. Henry Antonio Aulestia Canales
   Technical Department, Traffic Commission of the Province of Guayas

2. Mr. Evaristo Villón Mateo
   Technical Department, Traffic Commission of the Province of Guayas

3. Mr. Jorge Vera Burgos
   Technical Department, Traffic Commission of the Province of Guayas

CHAPTER 2.

EXISTING CONDITIONS OF URBAN TRANSPORT



Chapter 2 EXISTING CONDITIONS OF URBAN TRANSPORT

2-1 EXISTING ROAD CONDITIONS

2-1.1 Organization of Road Management

The roads in Ecuador are under the control of MOP (Ministerio de Obras Publicas) according to the Law of Roads (Ley de Caminos). The MOP divides the whole country into 7 regions and has an office in each region. One of the MOP's offices is located in Guayaquil. The roads in the Study Area are controlled and managed by the following governmental bodies:

(1) MOP in Guayaquil

In charge of design, construction and maintenance work of the national roads.

(2) Province of Guayas (Consejo Provincial Guayas)

In charge of mainly maintenance work of a part of the national roads.

(3) Guayaquil Municipality

In charge of design, construction and maintenance work of the roads within the urban area in Guayaquil.

The above governmental bodies maintain their own construction equipment, however the construction capability of the province of Guayas and the Guayaquil Municipality are lower than that of MOP. The large scale of road constructions in the Study Area are conducted by MOP.

2-1.2 Existing Road Network Pattern

The road network in Guayaquil is a typical grid pattern especially in the urban area. However, this pattern is confined by the barriers of Estero in the west and Cerro el Carmen in the north, within the limited urban area. The grid pattern of the roads in this urban area is connected to the major roads that form a radial pattern in the west, south and north. The road network pattern is shown as follows:

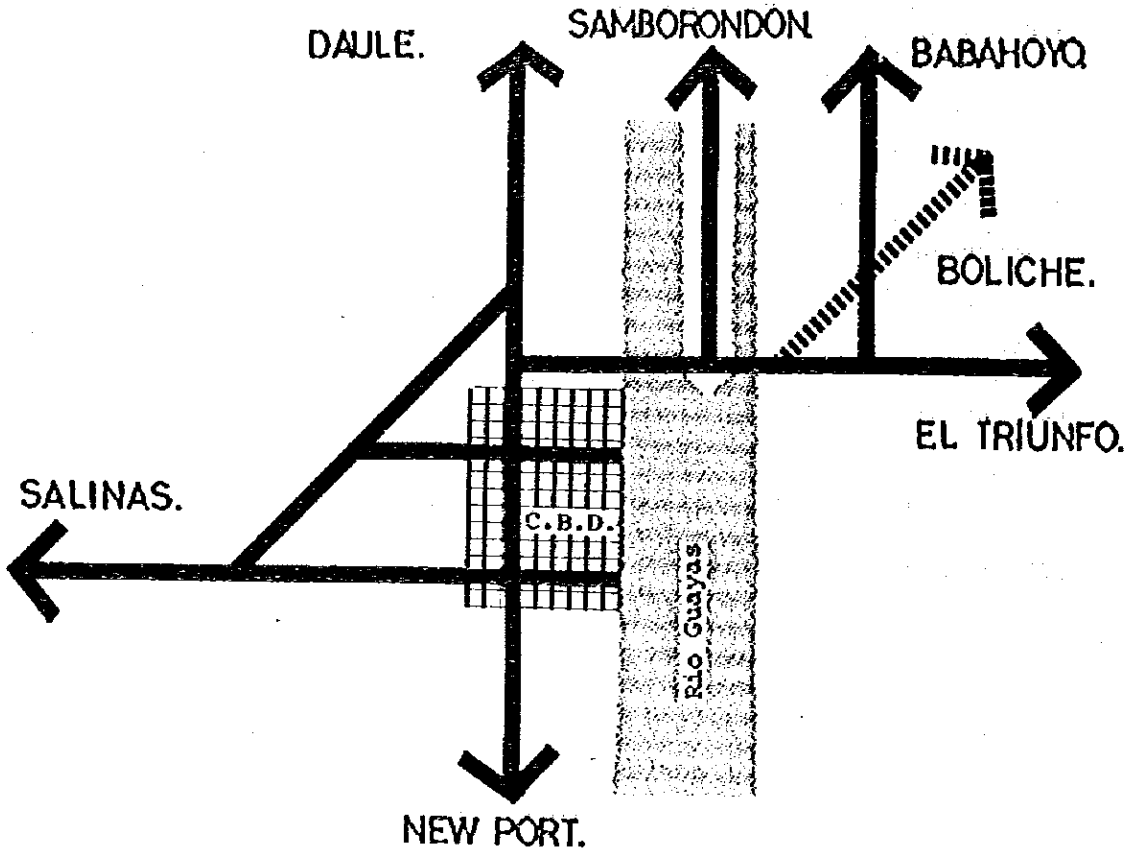


Figure 2-1.1 ROAD NETWORK PATTERN

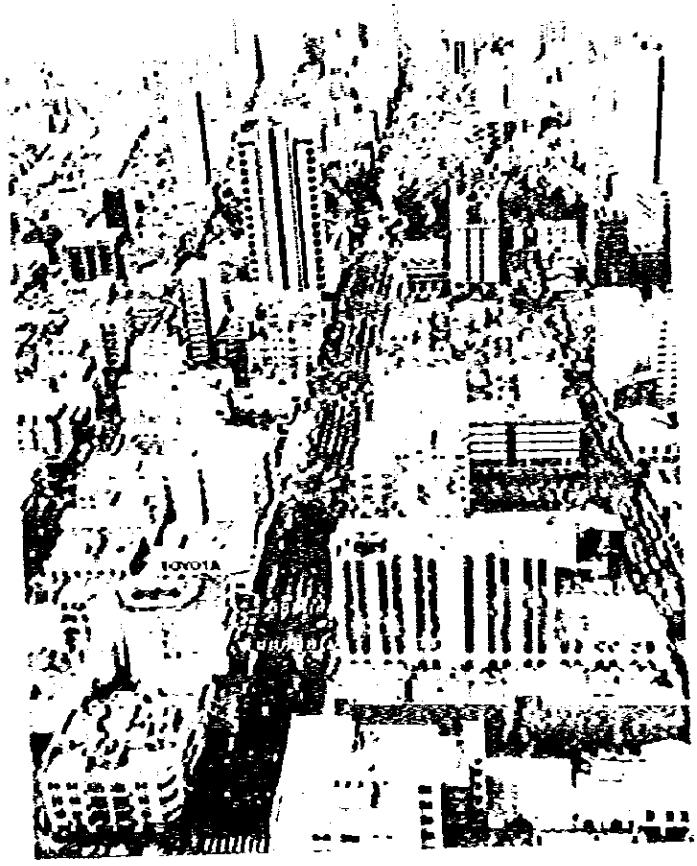
2-1.3 Existing Conditions of Road Utilization

Most of the roads in the urban area have a width of 15 m to 20 m and there are no roads less than the said width. Except the Av. 9 de Octubre, all the roads are utilized in one way.

Normal signal facilities are installed at intersections. There are 5 roundabouts of considerable scale. In contrast to crossing intersections with no signal installation in general signal facilities are installed for these roundabouts because of the concentration of traffic. In the urban area, 7 to 8 intersections are located at about 500 m interval and this causes a decrease in the road capacity.

In the western area, the Occupied road rates shows a normal

Most of the roads are composed of the dense grid-pattern shown in the picture



An exarple of un-paved roads in the western residential area

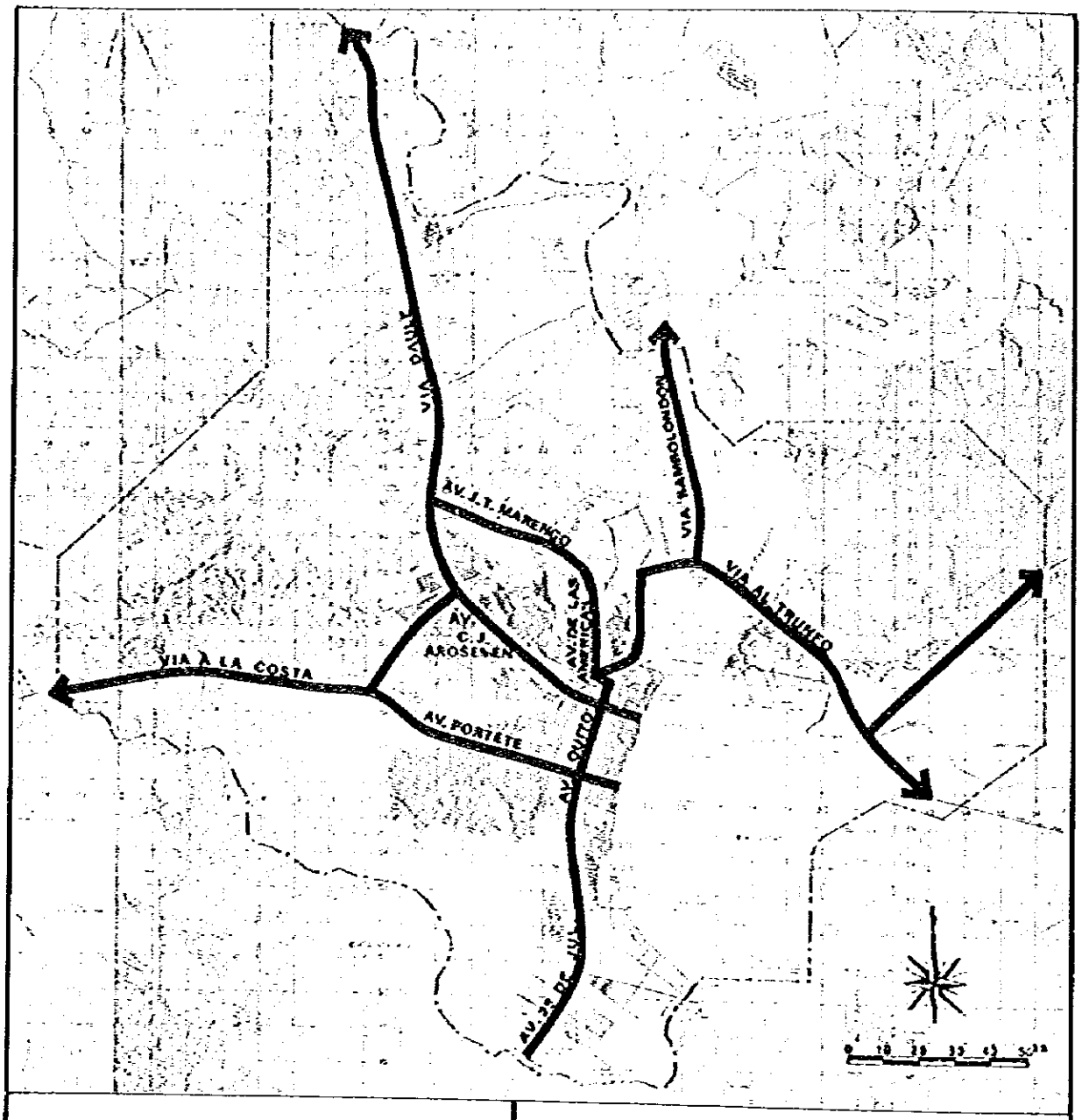


Figure 2-1-2 EXISTING MAJOR ROAD NETWORK

THE STUDY OF THE GUAYAQUIL CITY URBAN TRANSPORTATION PLAN

value (refer Table 2-1.1), however, the road pavement ratio is low. Only a few major roads are paved and the other roads are difficult to drive through because of the many puddle holes and soil bulks on these roads.

Table 2-1.1 OCCUPIED ROAD RATES

Item \ Zone	A-1	A-2	A-3	A-6
Characteristic of Zone	C.B.D.	Surrounding Area of Residential and Factory Zones	Surrounding Area of C B D Residential Zones	Residential Zones
Occupied Road Rates	31.4	30.0	25.49	15.36
Pavement Rates	100.0	87.96	43.42	7.2

C.B.D. (Central Business District .... Casco Central)

Sidewalks are adequately provided for most of roads. Though almost all sidewalks have width of about 5.0 m, some sidewalks are rather narrow, measuring only 1.5 m. However, a sufficient right-of-way for the sidewalks is ensured with a total width of about 4.0 m including an extra 3.0 m from the border of the private estate. This extra is called Portal. In the urban area, the right-of-way of the road is defined as that exclusive of the Portal. In the suburban area, a width of 25 m to 75 m from the road shoulder has been designated as the right-of-way of the road.

2-1.4 Existing Parking Conditions

The existing conditions of the parking facilities in CBD are shown in Figure 2-1.3 and utilization of their facilities are shown in Table 2-1.2.

According to the inventory survey of the existing parking facilities, the parking capacity in CBD is estimated to be 11,802 vehicles and the parking demand at present is estimated to be 10,817 vehicles per day on the other hand. The difference

between the capacity and demand may show the extra capacity left in CBD, however, it is actually observed that most of the vehicles in CBD are always looking for parking spaces.

Table 2-1.2 PRESENT CONDITIONS OF PARKING

Vehicles

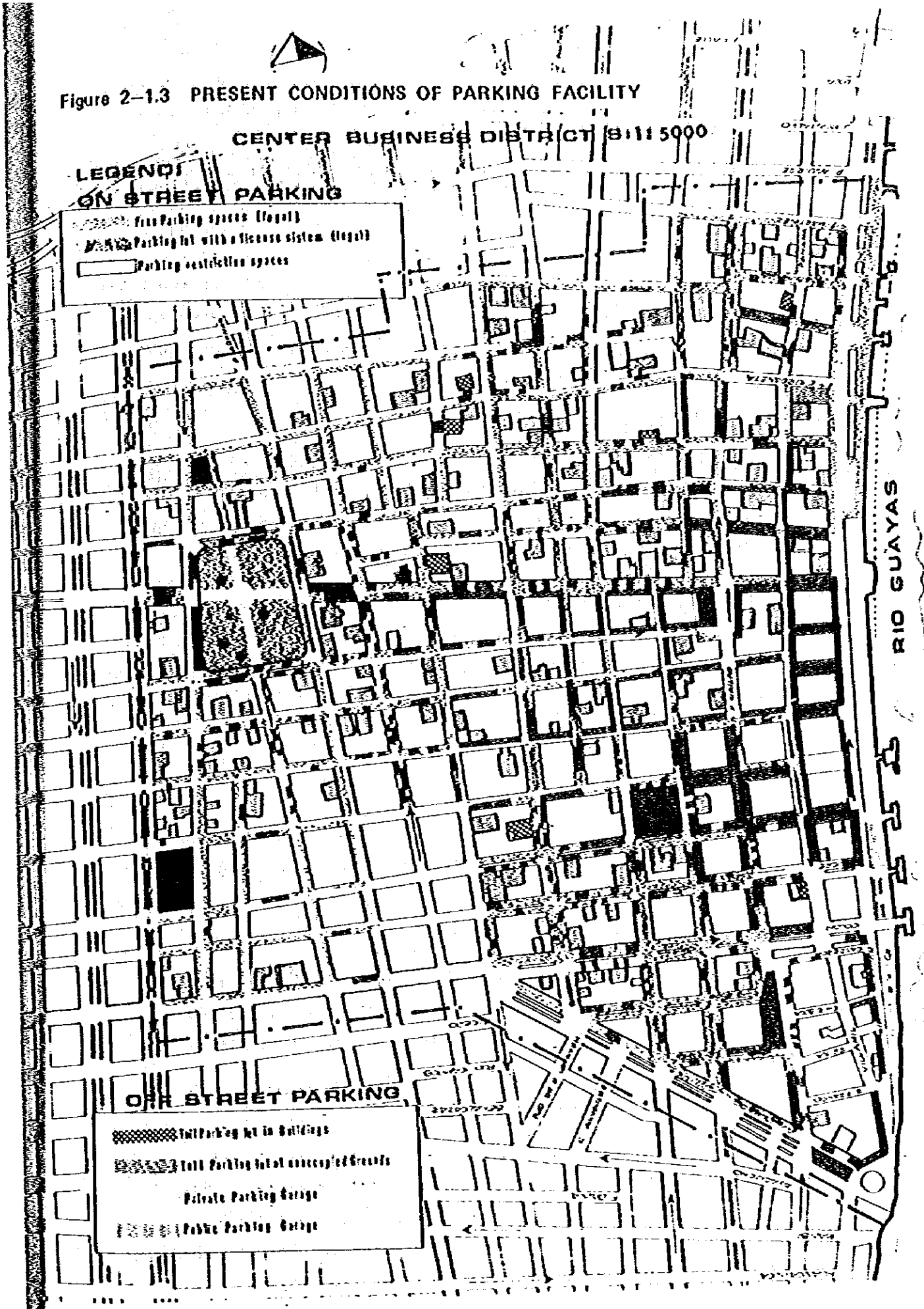
Type of parking lot / Item		Parking capacity	Number of unit parked		Average hour of parking (Day time)
			At night	Day time	
On-street Parking lot	Free parking	3,157	1,582	2,781	89 minutes
	Parking at parking meters	-	-	-	-
	Parking by License system	2,963	1,234	1,659	80
Off-street Parking lot	Toll parking	2,478	657	2,277	130
	Private and exclusive park.	3,204	486	2,651	190
Illegal parking		2,558	956	1,449	60
Total		13,360	4,915	10,817	-

Present conditions of toll off-street parking

Vehicles

Toll parking lot	Parking capacity	Number of unit parked
Building	390	305
Unoccupied ground	2,088	2,629

Figure 2-1.3 PRESENT CONDITIONS OF PARKING FACILITY



2-1.5 Problems of Existing Roads

The problems of the existing roads in Guayaquil are summarized as follows:

1) Shortage of Major Roads

The major traffic axes, (namely the major roads) run north to south and east to west. However, a shortage of such axes causes the heavy commuting traffic to converge to the above major roads 3 times a day.

2) Inflow of Through Traffic into CBD

The traffic generated at the port in the south and the airport in the north pass through CBD. This traffic is mixed with the business movement in CBD and accelerate the congestion.

3) Low Road Pavement Ratio in Surrounding Area

The road pavement ratio in the western and southern area is lower than that in CBD. Therefore the traffic tends to converge to the paved roads in these area.

4) Serious Roadside Parking

5) Less Lanemark Denotation

The partition of the traffic lane is not distinguishable. This causes lane confusion among vehicles, especially at intersections.

6) Pedestrian Crossing

Pedestrians cross the roads everywhere, not at the designated crosswalks. This disturbs the smooth flow of vehicles and exposes themselves to very dangerous situation.

7) Getting On-Off of Buses

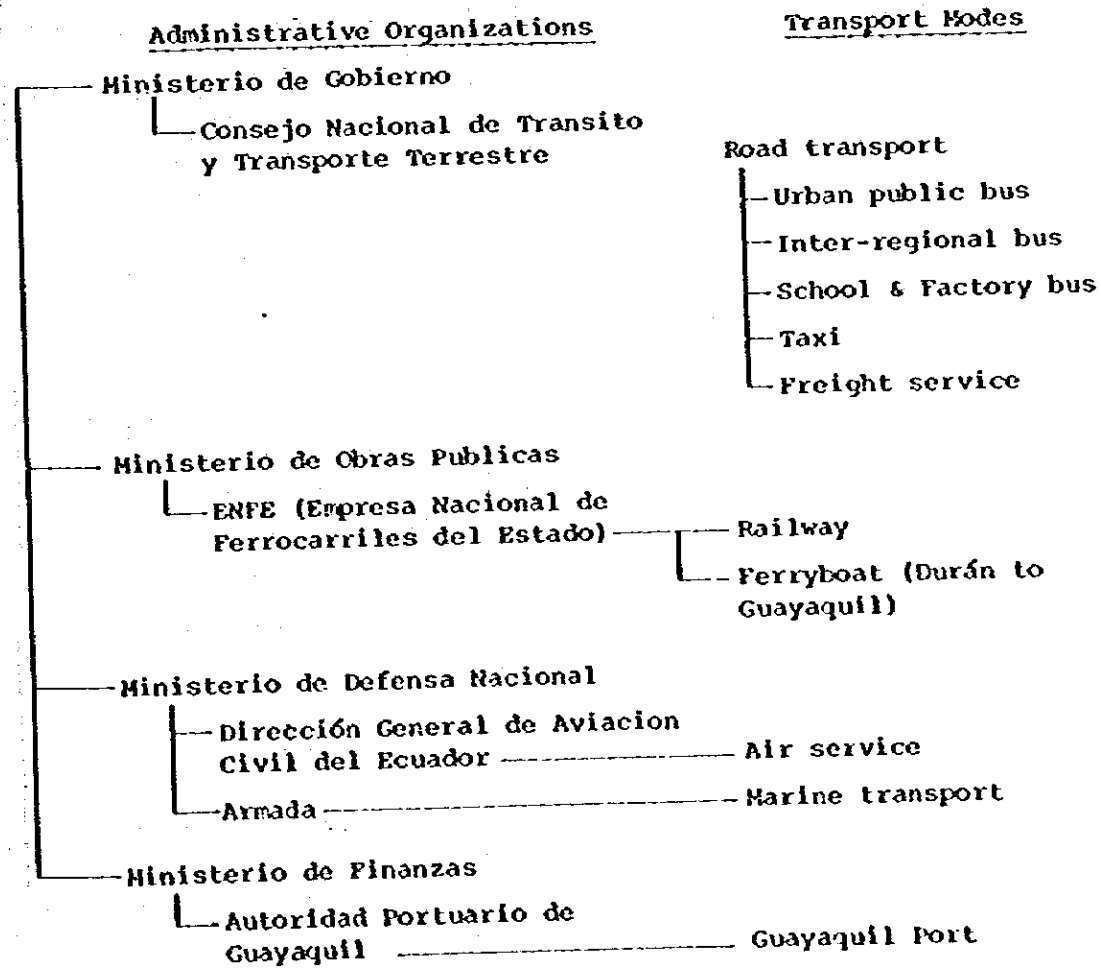
Although there are specified bus stops, the buses are permitted to stop at the non-established spots. This increases the stopping times of the buses. In addition, the buses do not always stop at the outer lane of the road. These conditions also decrease the road capacity.

2-2 PUBLIC TRANSPORT CONDITIONS

At present, public transport services in the Study Area are provided by the following transport modes.

(1) Buses
  a. Urban public bus ; to operate within "Canton Guayaquil" in principle
  b. Inter-regional public bus ; to ply between this Study Area and the outside area
  c. School and Factory bus ; to operate for school and factory
(2) Taxies ; to operate in the Study Area
(3) Rail services ; to provide inter-regional transport
(4) Air services ; to provide inter-regional and international transport
(5) Ferry services ; to operate in the Study Area and other ports outside the Area

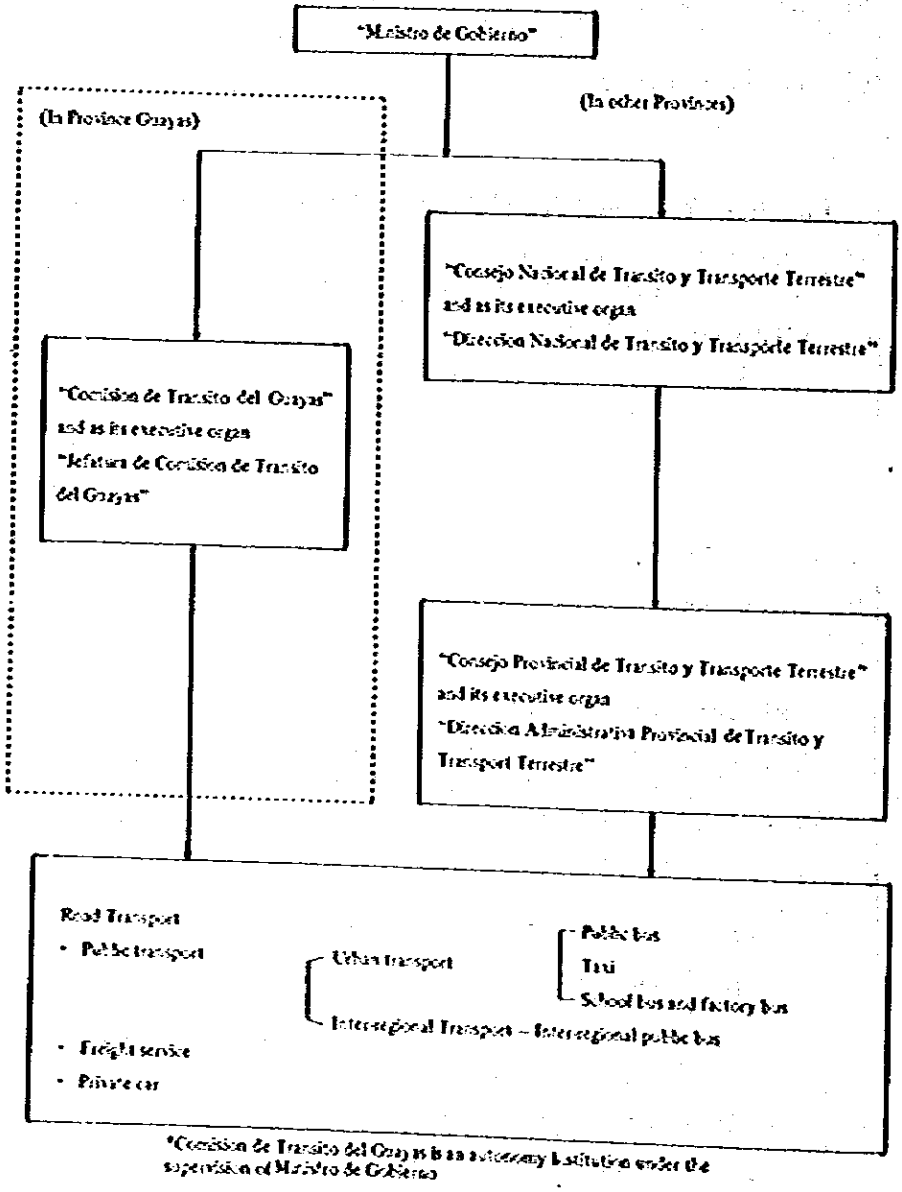
Figure 2-2.1 ADMINISTRATIVE ORGANIZATIONS FOR TRANSPORT



2-2.1 Administrative Organizations of Road Transport

Including private cars, the road transport is regulated uniformly by "Ley de Transito y Transporte" (Law of Transit and Transport). The general organization of road transport is shown in Figure 2-2.2. "Consejo Nacional de Transito y Transporte Terrestre" (National Council of Transit and Transport by land) administrates all affairs concerned with road transport in all other provinces except Guayas that is executed by C.T.G. (Comision de Transito del Guayas).

Figure 2-2.2 ROAD TRANSPORT ORGANIZATION



2-2.2 Bus

1) Urban Public Bus

a. Organization of Bus Transport

Urban public bus services are provided by private enterprises called "Cooperativo" (cooperative association), and it comprises more than eleven copartners who bring the capital such as buses, other facilities, into their "Cooperativo". It is very interesting that each "Cooperativo" named "Group" change its operating route weekly one after another to make its situation equal to others.

b. Existing Conditions of Bus Operation

The density of urban bus network is fairly high except for the northern area developing newly as shown in Figure 2-2.3, and the frequency thereof is fairly high except some routes. At present, the bus routes within CBD (Central Business District) are fewer than those in CUA (Central Urban Area). Most of the bus routes are concentrated on the perimeter roads of CBD. It is because that it is difficult for urban public buses to run smoothly within CBD

Table 2-2.1 CLASSIFICATION OF PUBLIC TRANSPORT

Definition	Capacity	Licence Plate	Restriction on Use	Remarks
a) Urban bus	10 ~ 30 persons	Commerce	. To operate authorized routes in principle . No schedule but frequency is controlled by C.T.G. . Uniform fare system	The route is located within the urbanized area.
b) Inter-Cantonal bus	Various types	Commerce	. To operate authorized routes . Scheduled operation . Fare level is determined by each route	In practice, some routes are used as the urban transport for commuters to Guyaquil
c) School bus	Various types	Commerce	. To transport pupils and school staff . Sometimes they operate urban bus routes under the control of urban bus company in the night	During school vacation they are used as a chartered bus
d) Factory bus			. Same operation as above	Same as Above
e) Taxi		Commerce	. Authorized fare level according to distance	One type has exclusive taxi station in the places such as hotel or airport, and another type is cruising on roads

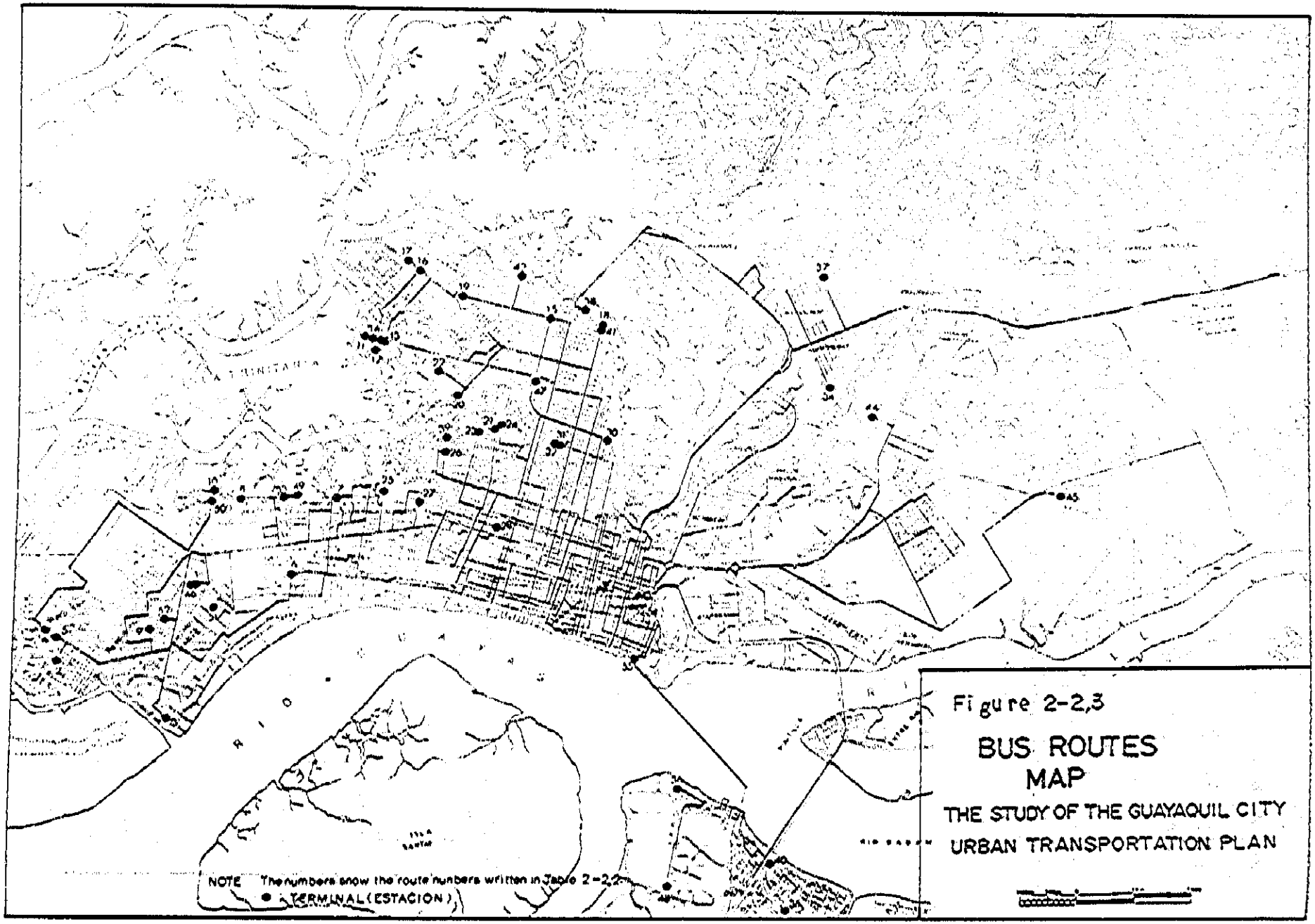


Figure 2-2,3

BUS ROUTES MAP

THE STUDY OF THE GUAYAQUIL CITY URBAN TRANSPORTATION PLAN

where traffic volume is too large and the roadside is over crowded with parking cars. Therefore, the passengers of buses to CBD have to walk or use taxis.

Most of bus stops are fixed by the signs or marks but very few with shelter. At the bus stop the information services such as route maps, schedules, route numbers for users are scarecely rendered. In spite of these bus stops being provided, every bus picks up and drops off passengers at any place they request.

The free ride system seemed to be convenient for passengers when the traffic volume was small, but now it seems to disturb smooth flow of other traffic means and expose passengers to very dangerous situation, because of the increase in traffic volume.

c. Type of Vehicle

Many kinds of vehicles are used for transport but, in principle, they are classified into two categories depending on their capacity as below:

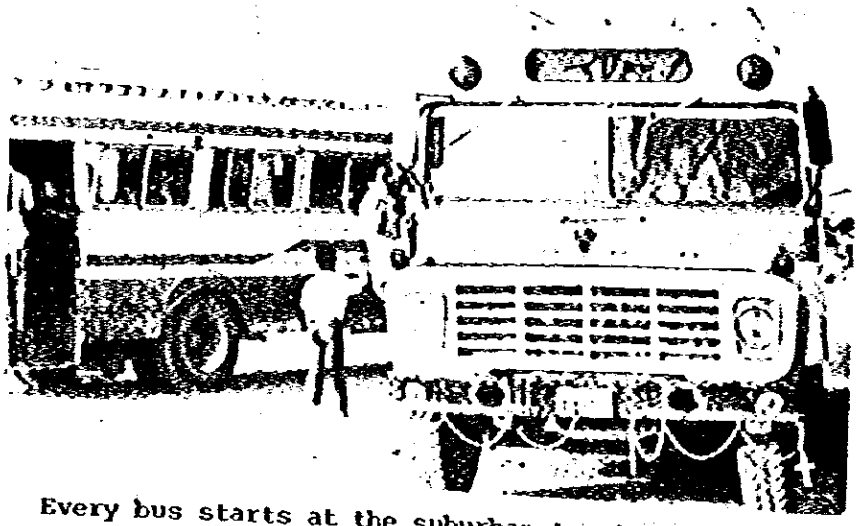
Capacity (persons)	Name called
. 30 ∿ 45	Bus, Colectivo, Colectivo Especial
. 10 ∿ 20	Buseta, Furgoneta, Camioneta

d. Existing Fare System

The sphere of the uniform rate system is limited within "Parroquias Urbanas" and "Durán" in principle.

The fares of mini buses called "Buseta" or "Furgoneta" are higher than those of ordinary buses called "Colectivo" and "Bus" according to their service level. Mini bus provides better service with less or equal passengers than their seat capacity. In the same way, "Colectivo Especial" provides better service and charges higher fare, but its route is one to the airport now. This fare system seems to be useful for users, because they can select various buses according to their demand. The demand for the fare system by distance is rising on the suppliers side, in proportion to extension of the urban area and decreaserent of running

One example of few bus-stops with the shelter.



Every bus starts at the suburban terminals loading passengers to its full capacity in the peak hour.

speed. They say some routes are too long for one uniform fare.

e. Velocity of Urban Public Bus

The velocities of buses are 12 to 16 Km/h and not so different by direction and by area because the routes in CBD are limited to arterial roads, and the routes in suburbs are located in various roads including unpaved roads where buses cannot run smoothly.

2) Inter-Regional Bus

The inter-regional buses called "Inter ciudad, cantonal and provincial bus" are administrated by C.T.G. and "Consejo Nacional de Transito y Transporte Terrestre". The fares and the routes are examined and permitted by them when the bus enterprises intend to establish new routes or to change the fare system. These enterprises are usually called "Cooperativo" same as the organs of the urban public buses. The fare is determined by each route and differs by each service distance. C.T.G. controls the schedule, load factor, and other affairs concerned with operations. Different from those of the urban public buses, "Estaciόns" are mostly situated around CBD. They have their exclusive parks for buses, passengers' waiting rooms, and other facilities to serve passengers. But their capacities are not enough for the recent increase of passengers. As the countermeasure, a new integrated bus terminal is now under construction in the northern area to admit many "Estacions". It is expected that the bus terminal contributes to alleviation of traffic congetion and development of the land use in CUA and CBD.

3) School Bus and Factory Bus

The forms of school and factory bus transport comprise three categories. The buses in the first category are owned by schools or factories and have the private nurber plates which provide transport service for their students and workers. The buses in the second category are equal to other public transport systems and "Cooperativo" provides transport service.

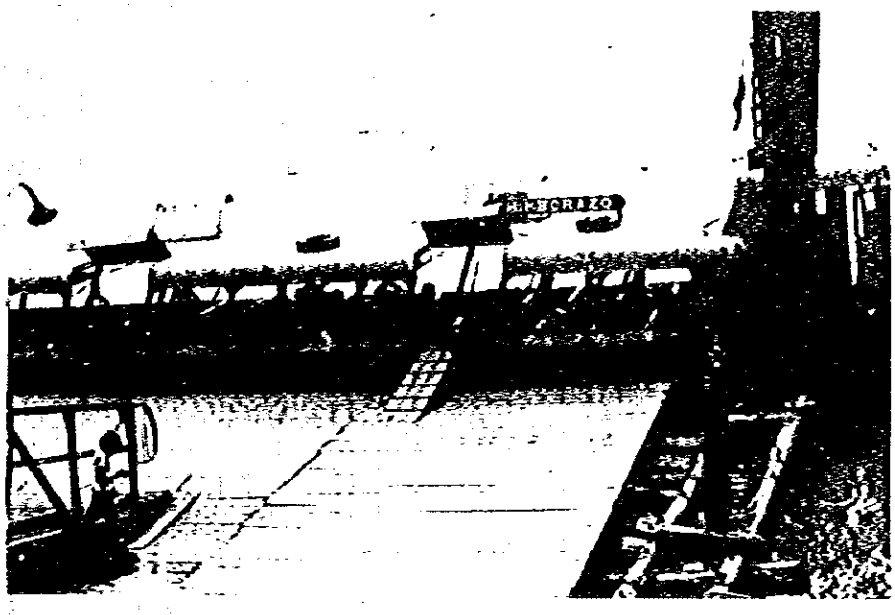
In the third category, vans or wagons provide transport service with the private nurber plates. The vehicles are inspected more elaborately than ordinary cars. The fares are collected through school or directly from users. It seems that the factory bus users are not so many since the other public transport means are useful for factory workers, but the school buses are useful especially for the students of night classes which are very common in Ecuador. The fare levels are decided on the basis of urban bus fare by the Committee including suppliers and users.

4) Actual Movement of Passengers

The Table 2-2.2 shows the total nurber of passengers transported and the nurber of bus trips operated in each route per day by the urban public buses. The nurber includes passengers transported by ferryboats to Duran and by buses to Pascuales as a kind of inter-regional. The nurber of passengers is estirated to be approxirately 850 thousand a day, and the nurber of bus round trips is estirated 7,000 a day (7,000 trips in each direction). The Figure 2-2.4 shows the desire lines of bus passengers.

2-2.3 Taxi

The permission of taxi licence and fare systen are controlled by C.T.G. Organization of taxi enterprises corprise two types; one is "Cooperativo" which is sare as that of the enterprise of urban public bus and another is free drivers who don't organize "Cooperativo" but called "Pre-Cooperativo". Sore "Cooperativos" serve exclusively in the airport or at hotels, based on the contract with respective ranagers. At present the taxies are not necessarily equipped with taxi neters, but now C.T.G. is studying how to do so without fare increase. Sore taxi stations are distributed in CBD for the convenience of users, but the private cars usually occupy then as parks in practice. The nurber of taxies is approxirately 9 thousand in the Study Area, and their actual novement is shown in Figure 2-2.5.



This ferry system carries 2,700 passengers a day between Duran and Av. Malecon Simon Bolivar.

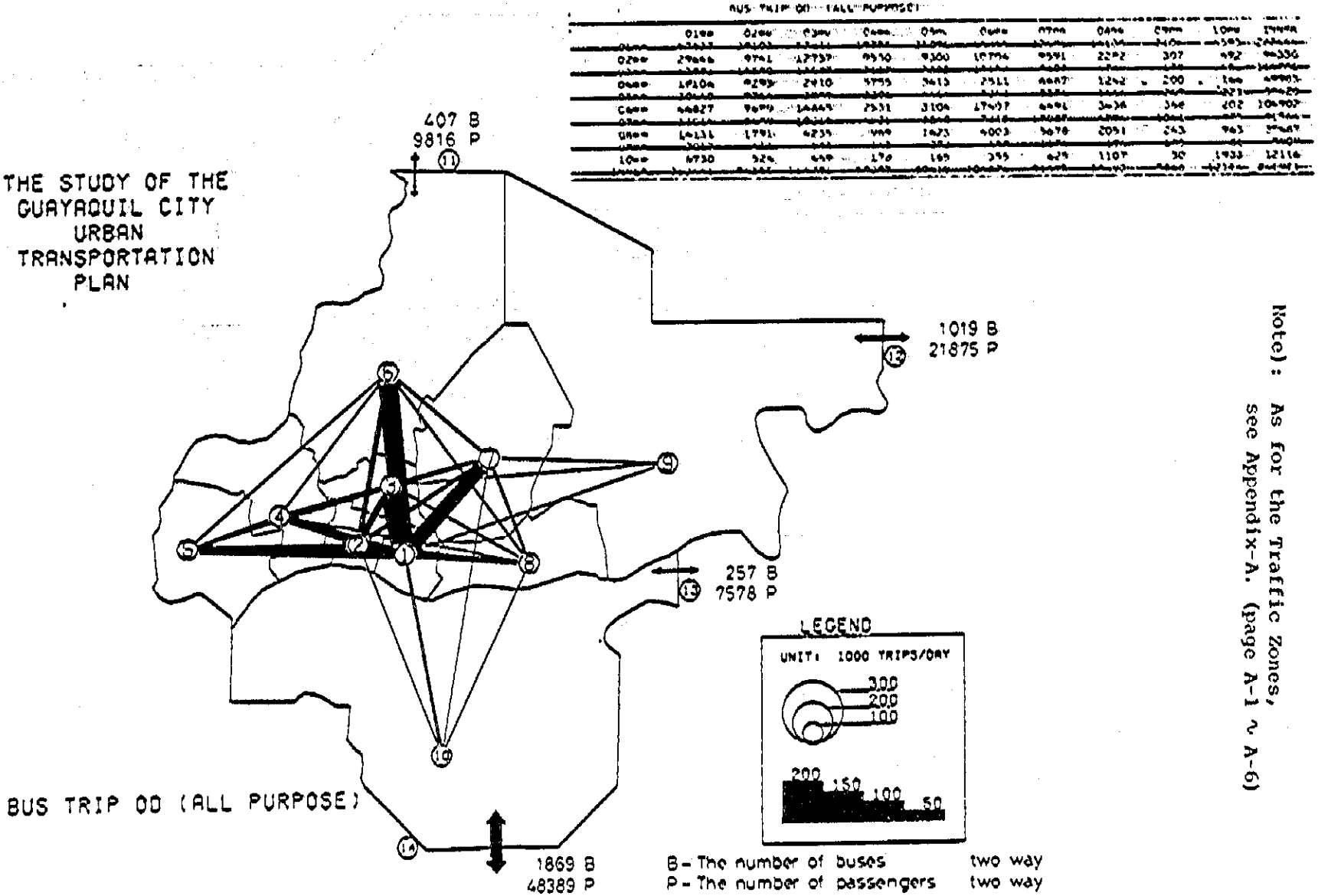
Taxis are used very conveniently in daily life and their registered number has increased rapidly in contrast with buses'.

Table 2-2.2 BUS PASSENGERS AND BUS TRIPS

No.	Route Name	No. of Passen-gers	No. of Bus Trip	No.	Route Name	No. of Passen-gers	No. of Bus Trip
1	27	4563	64*	29	39 Pascuales	10851	94*
2	23 Reina del Guasmo	8630	58*	30	6 (Bus)	17380	99*
3	22	6759	77*	31	2 Especial	16138	140*
4	1 Florida	9565	80*	32	2	30959	176*
5	19	17640	116*	33	35 Garberra	5133	162*
6	13	20831	126*	34	Ruta 15	11878	221*
7	9	24782	129*	35	17	17853	132*
8	3	18881	128*	36	17 A	19817	93*
9	21	19600	136*	37	1	28487	167*
10	28(10 de Marzo)	10278	129*	38	Puente Portete	1484	74
11	25	12051	87*	39	11 (Bus) Tarqui	20414	140
12	4	27102	187*	40	Reina de Durán	136	62
13	5-B	19001	104*	41	7 Eloy Alfaro	20320	143
14	24	14653	110*	42	5-A Perla del Pacífico	20447	154
15	10 (Bus)	4142	30*	43	Alborada Sauces	7616	173
16	20 (Transperla)	10447	70*	44	Flecha Verde #5	11843	275
17	22 (Popular)	23682	179*	45	Flecha Verde #3	1924	51
18	7	23698	124*	46	Flecha Verde #1	1027	25
19	15	26684	197*	47	Abdala B.	2314	61
20	2 (Bus)	14050	94*	48	17-A Eloy Alfaro	5929	101
21	6	23667	120*	49	3 Luz del Guayas	19057	136
22	16	29031	143*	50	26 Santiago de Guayaquil	8047	87
23	11	31715	233*	51	Hermano Miguel	5280	146
24	5	38481	203*	52	Rosa Aguilera	4297	74
25	14	26009	159*	53	Ciudadelas Unidas #1	14960	330
26	8	24294	133*	54	Ciudadelas Unidas #2	4912	116
27	10	21879	154*	55	Ferry	2647	51*
28	12	18890	129*		Total	842155	6982

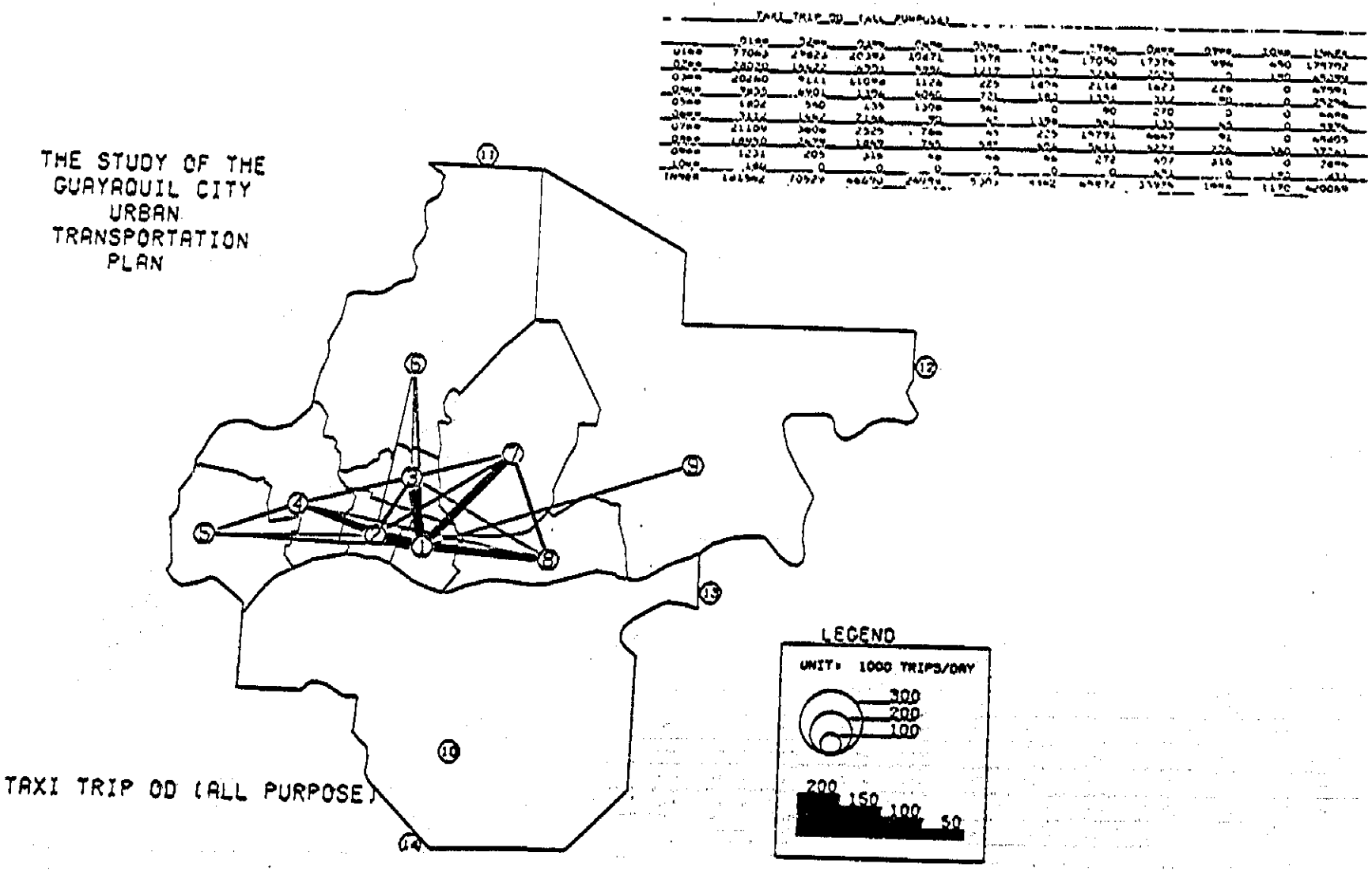
The total nurber of passengers presured is 842,155 * Interviewed
The total nurber of round trips is 6,982
The nurber of passengers interviewed is 61,447
The nurber of bus trip interviewed is 917
Sarpling rate is 7.3%
** 1 round trip equals to both ways except Ferry.

Fig. 2-2.4 BUS TRIP OD



Note): As for the Traffic Zones, see Appendix-A. (page A-1 ~ A-6)

Fig. 2–2.5 TAXI TRIP OD



2-2.4 Railway

Rail services are provided by "ENFE" (Empresa Nacional de Ferrocarril del Estado) who is controlled by "Consejo Nacional de Ferrocarriles" under the supersivion of "Ministerio de Obras Publicas y Comunicaciones". The railway network and the trends of movements both in freight and passengers are shown in Appendix-B. According to those, freight tonnages transported have decreased gradually, while the number of passengers transported had increased year by year until 1969.

For the last decade, however, it has dropped down to the level of a half of the maximum number. Taking into account the volume by inter-regional public buses, it seems that the railway service has not been playing an important role in the inter-regional transport around the Study Area. In order to modernize the railway system and fulfill its functions of long distance and mass transport, more effective, new investment for rehabilitation, electrification, and expansion of the network to coastal region is planned, but it seems to be difficult to actualize it successfully and rapidly.

In the Study Area there is one station at Durán where three trains arrive and depart every week day with less than 300 passengers a day.

The ferry boat system between Guayaquil and Duran is more useful than urban public buses since it serves directly to both points with high frequency.

Summary of facilities of ENFE

1. Length of line in operation

Guayaquil - Quito	446.0 km	Total 965 km
Quito - Ibara - San Lorenzo	373.5 km	
Sibambe - Cuenca	145.5 km	

2. Gauges - Narrow gauge (1,067 mm)

3. Rolling stock

Steam locomotive	(1,000 HP)	(pulling capacity 550t)	6
Diesel motor car	(1,200 HP)	(" 650)	4
"	(1,200 HP)	(" 1,500)	5

Auto carrier (Rail bus, Capacity 44 Person)	16
Passenger car	21
Freight car (capacity 45 t - 60 t)	124
Covered wagon (" 40 t - 45 t)	27
Gondola car (45 t - 60 t)	21

4. Water transport facilities

Ferry boat (capacity 40 t)	3
Launch (capacity 50 t)	3
Launch (100 persons)	6

Source: ENFE

2-2.5 Port

The port of Guayaquil biggest in Ecuador has served very much to development of Guayaquil as its tractive force. It deals with 70% of international trades in Ecuador, 83% of imports and 50% of exports only except petroleum which is dealt in the ports of Balao and La Libertado. In and around this port area, there are many international trading companies, financial agencies, storage houses, processing and packing industries, various bases for collection and delivery, etc. The trend of volume and the list of goods handled are shown in Appendix-C. Since the growth rate of imports is so extremly high as shown therein, the new port extending project started at 1981 by the World Bank loan and the arrangement of factory areas is being prepared in the hinterland of the port.

Summary of Port Facilities

	Public	Private
1. Length of wharf	1,637 m	309 m
2. Number of wharf	3	7
3. Warehouse with shed	58,458 m^2	6,500 ton and 8,661 m^2
4. Warehouse without shed	170,600 m^2	5,750 m^2
5. Shipping space	18,500 m^2	-
6. Silo	68,000 ton	90,000 ton
7. Tank	-	400,000 galones (11,000 ton)
8. Crane		
Movable crane under 50 ton	13	-
Movable crane over 50 ton	7	-
Jib portable Crane	3	-
Forklift	more than 200	4
Others	-	Pipe line system

Source: Boletin Estadistico 1981

Total traffic volume going in and out the port is given below.

Table 2-2.3 TOTAL TRAFFIC VOLUME OF GOING IN AND OUT OF THE PORT

(a day)

	CAR	TAXI	L.LORRY	H.LORRY	BUS	MOTOR CYCLE	TOTAL
Traffic volume	1,423	780	2,296	1,060	281	309	6,149
%	23.1	12.7	37.3	17.2	4.6	5.1	100.0
Average passengers per vehicle*	2.23	1.87	2.47	2.46	12.56	1.13	2.73
Estimated number of passengers*	3,173	1,458	5,671	2,607	3,529	349	16,787

Note: * including drivers

Sources: Main Transport Terminals Survey by the Study Team, 1982/7

2-2.6 Airport

The airport of Guayaquil is one of the two international airports in Ecuador and the other in Quito. It serves domestic lines and the air force, and the summary is as follows;

Main equipments : Size of the airport 120 ha
Number of runway 1
Length of runway 2,440 m
Gross floor space of buildings 12,000 m^2

Number of flights: International average 10/a day
Domestic " 30 "

Number of passengers : Shown in Table 2-2.4

Table 2-2.4 HOURLY FLUCTUATION OF AIRPORT PASSENGERS

(a day)

ITEMS / TIME	NATIONAL N° OF PASSENGERS			INTERNATIONAL N° OF PASSENGERS		
	ARRIVAL	DEPARTURE	TOTAL	ARRIVAL	DEPARTURE	TOTAL
6:00- 7:00	-	124	124	102	-	102
7:00- 8:00	159	100	259	-	10	10
8:00- 9:00	-	120	120	-	8	8
9:00-10:00	90	-	90	26	24	50
10:00-11:00	203	148	351	17	11	28
11:00-12:00	20	-	20	-	32	32
12:00-13:00	98	183	281	-	68	68
13:00-14:00	-	72	72	21	9	30
14:00-15:00	92	-	92	-	32	32
15:00-16:00	166	150	316	-	-	-
16:00-17:00	13	120	133	77	-	77
17:00-18:00	207	125	332	73	-	80
18:00-19:00	117	70	187	-	-	-
19:00-20:00	60	-	60	-	-	-
20:00-21:00	-	-	-	-	-	-
21:00-22:00	-	-	-	-	-	-
Total	1,225	1,212	2,437	316	201	517

Sources: Main Transport Terminal Survey by the Study Team, July 1982

2-3 PRIVATE VEHICLES' CHARACTERISTICS

2-3.1 Number of Trips

Based on the car owner survey, several traffic characteristics in the Study Area was obtained. In 1982 at present, 609,471 vehicular trips are produced in the Study Area. They consist of 582,265 internal trips, 24,315 external trips and 2,891 through trips as shown in Table 2-3.1. With regard to the vehicular composition of the internal trip, 34.6% (201,192 trips) are made by ordinary cars, 51.7% (301,103 trips) by light trucks and the rest by heavy trucks and motorcycles.

Table 2-3.1 EXISTING VEHICULAR TRIPS MADE IN STUDY AREA

Unit: Vehicle trips/day

Trip type / Vehicle type	Internal trip	External trip	Through trip	Total
Ordinary Car	201,192	4,469	223	205,884
Light truck	301,103	12,776	1,055	314,934
Heavy truck	28,875	6,189	1,596	36,660
Motorcycle	51,095	881	17	51,993
Total private vehicle	582,265	24,315	2,891	609,471

Source; Car Owner Interview Survey by the Study Team, July 1982.

The percentage distribution of trip purpose by each vehicle type is given in Table 2-3.2. As shown in the table the trip purpose of to school, has fewer percentage share in any type of vehicle while the business trip are made very often, especially over 60. percentage in heavy trucks. Vehicle composition in each trip purpose shows almost same pattern.

The trip production rate for each vehicle type is shown in Table 2-3.3. A vehicle in the Study Area makes average 6.3 trips one day with small variation among vehicle types. Light trucks are used most frequently in comparison with ordinary cars which are the least. Average car occupancy rate was also aggregated from the car owner survey and its result is shown in Table 2-3.4. The biggest occupancy rate of all vehicle types is for light truck while the fewest is for ordinary cars.

Table 2-3.2 TRIP PURPOSE COMPOSITION BY VEHICLE TYPE

Unit: Percentage

Purpose / Vehicle	To work	To school	Business	Private	To home	Almuerzo	All purpose
Ordinary car	13.7 37.6	3.5 43.3	12.3 17.5	27.2 42.1	28.3 38.5	15.0 41.2	100.0 34.6
Light truck	12.0 49.2	2.4 44.6	28.1 59.8	21.3 49.3	24.6 50.0	11.6 47.8	100.0 51.7
Heavy truck	11.4 4.5	0.1 0.2	62.8 12.8	5.2 1.1	14.6 2.9	5.8 2.3	100.0 5.0
Motor-cycle	12.5 8.7	3.8 11.9	27.3 9.9	18.9 7.4	25.0 8.7	12.4 8.7	100.0 8.8
Total private vehicle	12.6 100.0	2.8 100.0	24.3 100.0	22.3 100.0	25.4 100.0	12.6 100.0	100.0 100.0

Note: Upper figure in each box shows the percentage in row-wise while lower in column-wise. Each percentage is on internal trips basis.

Table 2-3.3 AVERAGE TRIP PRODUCTION BY VEHICLE TYPE

Unit: Vehicle trip/day

Vehicle Type	No. of Samples	Trip Purpose						
		To work	To school	Busi-ness	Pri-vate	To home	To lunch	All-p
Car	37,576	0.739	0.188	0.664	1.467	1.533	0.809	5.400
Light truck	40,741	0.891	0.178	2.088	1.586	1.822	0.864	7.427
Heavy truck	5,194	0.627	0.005	3.514	0.288	0.819	0.326	5.578
Motorcycle	8,194	0.718	0.219	1.576	1.092	1.442	0.717	5.765
Total	92,430	0.798	0.176	1.540	1.417	1.611	0.797	6.339

Source: Car Owner Interview Survey by the Study Team

Table 2-3.4 AVERAGE CAR OCCUPANCY RATE BY VEHICLE TYPE

Unit: Persons/car

Vehicle Type	No. of Samples	Trip Purpose					
		To work	To school	Busi-ness	Pri-vate	To home	To lunch
Car	37,576	0.759	0.188	0.685	1.486	1.564	0.816
Light truck	40,741	0.922	0.179	2.186	1.612	1.879	0.876
Heavy truck	5,194	0.712	0.005	3.825	0.314	0.886	0.344
Motorcycle	8,919	0.733	0.219	1.580	1.099	1.457	0.717
Total	92,430	0.826	0.177	1.610	1.438	1.654	0.807

Source: Car Owner Interview Survey by the Study Team

2-3.2 Trip Generation and Attraction by Zone

Trip generation and attraction means zonal distribution of whole trips made in the Study Area and the both numbers were obtained through the enlargement of the car owner data. Both are shown in Table 2-3.5. The highest trip generation/attraction occurs in A-1 zone and amounts to 233,000 trip ends, around 40% of total trips in the Study Area. The trip generation in A-7 zone and A-2 zone follows it and amounts to more than 100,000 trip ends and 87,000 respectively. Trip generation in other zones is less than in those zones.

Note) A-zone numbers are shown in Fig. 2-3.1, and see Appendix-A for the further detail.

Table 2-3.5 PRESENT VEHICULAR TRIP GENERATION AND TRIP ATTRACTION BY ZONE

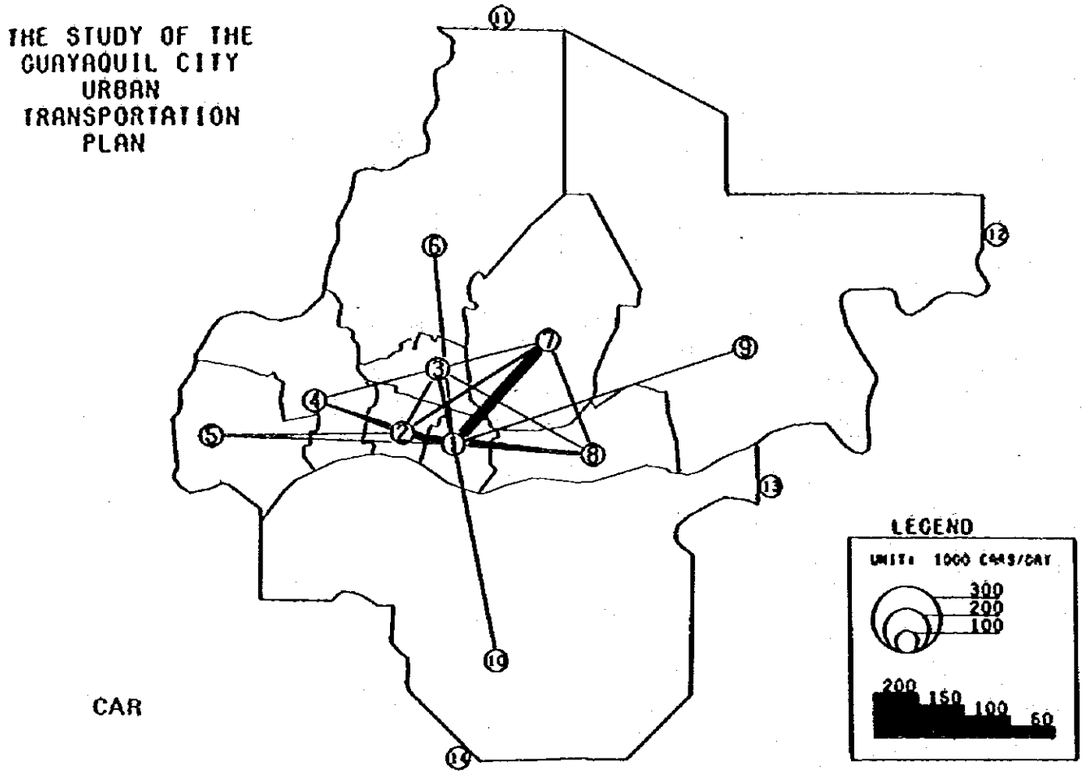
Unit: Vehicle trip/da

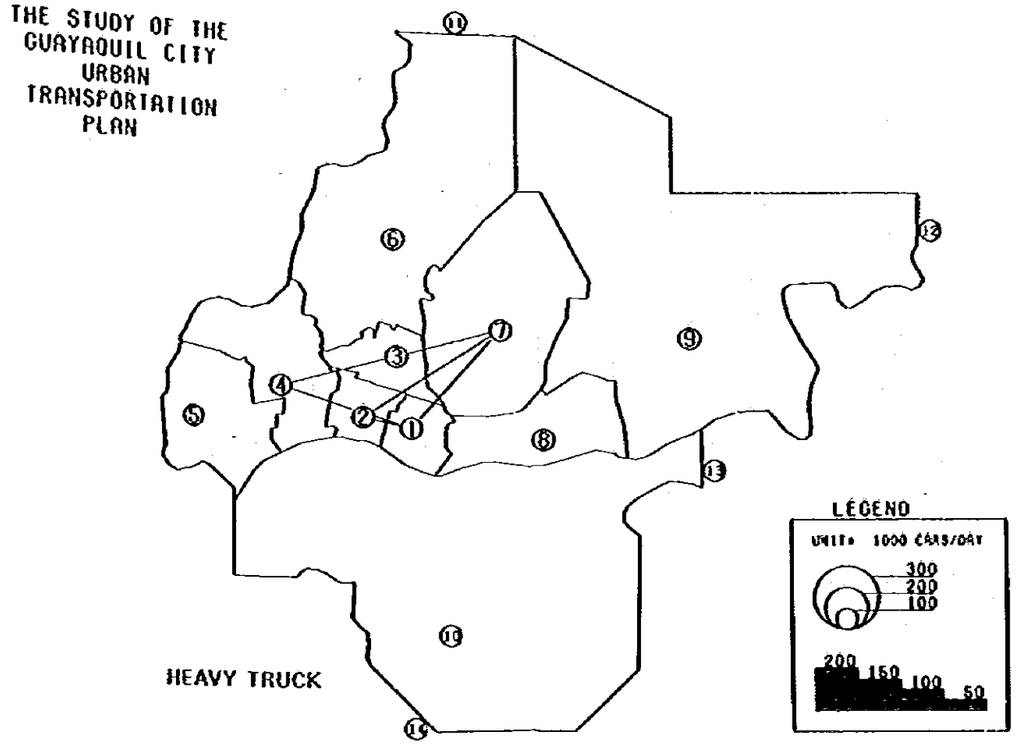
	A Zone \ Vehicle Type	Ordinary car	Light-truck	Heavy-truck	Motor-cycle	Total
Trip Generation	1	86,132	122,534	7,960	16,169	232,795
	2	28,245	44,698	4,334	10,140	87,417
	3	10,771	27,539	2,078	9,632	50,020
	4	9,739	15,388	1,816	2,094	29,037
	5	2,341	7,666	1,963	1,676	13,646
	6	1,643	7,338	1,530	1,677	12,188
	7	46,167	47,219	5,261	5,972	104,619
	8	12,707	18,720	1,517	1,898	34,842
	9	1,598	4,919	1,164	896	8,577
	10	1,849	5,082	1,252	941	9,124
	Study Area	201,192	301,103	28,875	51,095	582,265
Trip Attraction	1	85,951	122,475	7,887	16,266	232,579
	2	28,316	44,968	4,323	10,107	87,714
	3	10,888	27,586	2,139	9,534	50,147
	4	9,811	15,305	1,835	2,135	29,086
	5	2,419	7,654	1,928	1,716	13,717
	6	1,631	7,295	1,528	1,679	12,133
	7	46,226	47,318	5,166	5,882	104,592
	8	12,632	18,635	1,597	1,923	34,787
	9	1,438	4,817	1,186	877	8,318
	10	1,880	5,050	1,266	976	9,192
	Study Area	201,192	301,103	28,875	51,095	582,265

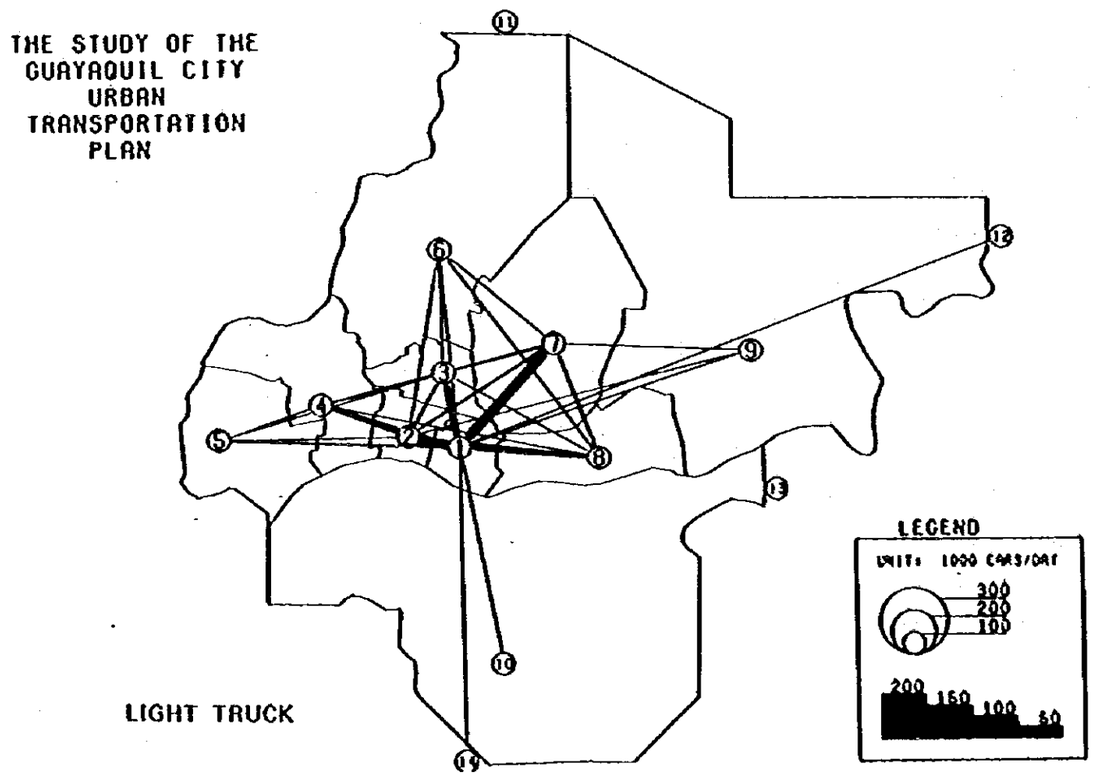
2-3.3 Desired Traffic Lines

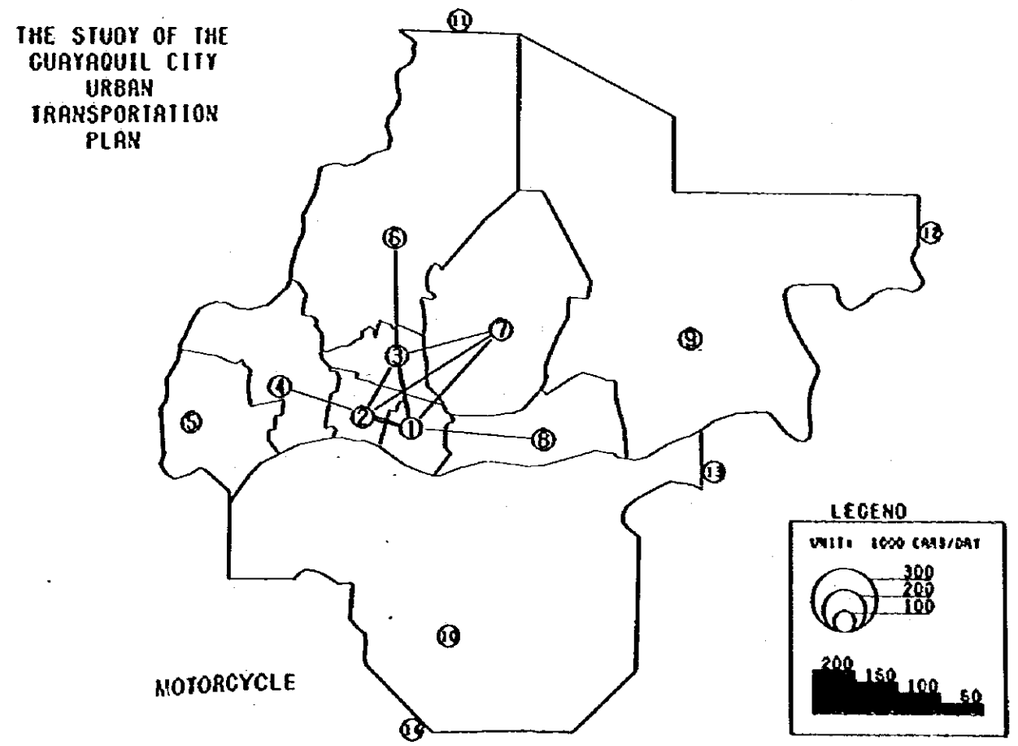
Present vehicle movement in the Study Area is illustrated in Figure 2-3.1 by vehicle type. According to this figure, the major traffic flow concentrates just to CBD, especially from 2, 3, 7 and 8 zone, which are close to CBD zone. On the contrary there is little traffic volume among the surrounding zones, which are supposed to be circular movement.

Figure 2-3.1 PRESENT DESIRED LINES OF VEHICLULAR TRIP









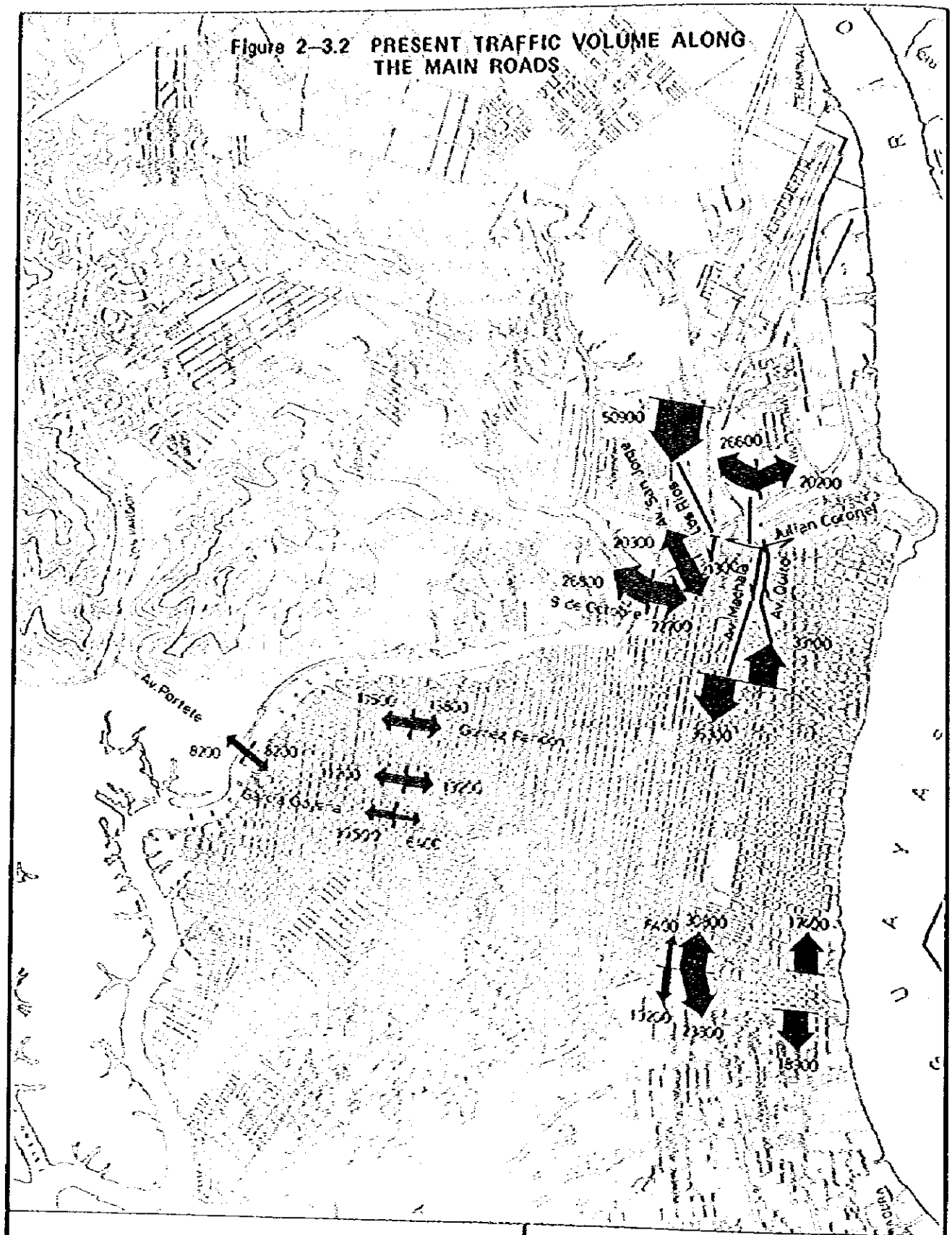
2-3.4 Traffic Flow on Major Roads

Figure 2-3.2 shows the present traffic volume on the main roads crossing the traffic screen lines, on which the Screen Line survey was conducted. The heaviest traffic volume for particular road sections occurs at the 25 de Julio section and totals to about 55,000 trips for both ways. The traffic volumes at calle Los rios, Av. Machala, Av. Quito and 9 de Octubre section come after that. It is pointed out that most of the heavier traffic volume is gathered at the narrow sections just behind CBD, which forms the bottle-neck in the urban traffic.

2-3.5 Peak Period Movement

Traffic hourly fluctuation was observed from the screen line survey result and cordon line survey result by each survey point, Figure 2-3.3 shows typical examples of the traffic hourly fluctuation. In general traffic hourly peak occurs both at morning period from 7 A.M. to 10 A.M. and evening period from 4 P.M. to 8 P.M. The peaking rate generally seems to be moderate although it depends on the road situation.

Figure 2-3.2 PRESENT TRAFFIC VOLUME ALONG THE MAIN ROADS



Source) Screen line counting survey by study team

0 0.5m 1km 2km 3km

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Figure 2-3.3 HOURLY FLUCTUATION OF TRAFFIC VOLUME