10.7 Public Transportation Plan

The study results clearly indicate that buses are the most popular mode of public transport and are expected to occupy 92.5% in passenger-km of the total public transportation demand in 2010. Measures to strengthen and improve bus service further in the study area are explained in this Section.

10.7.1 Basic Conditions for Planning

1) Future Demand for planning

Based on the future road network in 2010, the public transportation demand (including fixed route taxi) is estimated as shown in Fig.10.7.1. Among them, the highest demand is seen along the major radial roads on north-south and east-west transportation axes, followed by the Middle Ring Road.

2) Issues of Planning

(1) Public Transport Dominance

In general, the share of public transport trips tends to decrease according to increase of car ownership. However, the majority of the citizens use public transport which has advantages over private transport from an urban and regional development point of view particularly in regards to space requirement, economy, energy, and environment. Therefore, priority should be placed on public transport development to maintain good service and attract passengers.

(2) Public Transport Network Structure

Improvement of the public transport system includes full coverage of public transport routes, frequent operation, sufficient capacity, and maintenance of reasonable speeds. For improvement avoiding traffic congestion, a hierarchical structure should be introduced. This would consist of a high capacity system along major routes and feeder services along branch routes

(3) Priority Measures for Pubic Transport

To support and promote efforts for service improvement by the bus operators, the government should give priority to public transport by means of exclusive bus ways, exclusive bus lanes, bus terminals, bus stops and other non-physical measures.

10.7.2 Expansion of Fleet

1) Bus

Based on the results of traffic assignments, it is estimated that bus passenger demand, in terms of passenger-km, will increase 2.01 times over the next 15 years (1995-2010), as shown in Table 10.7.1.

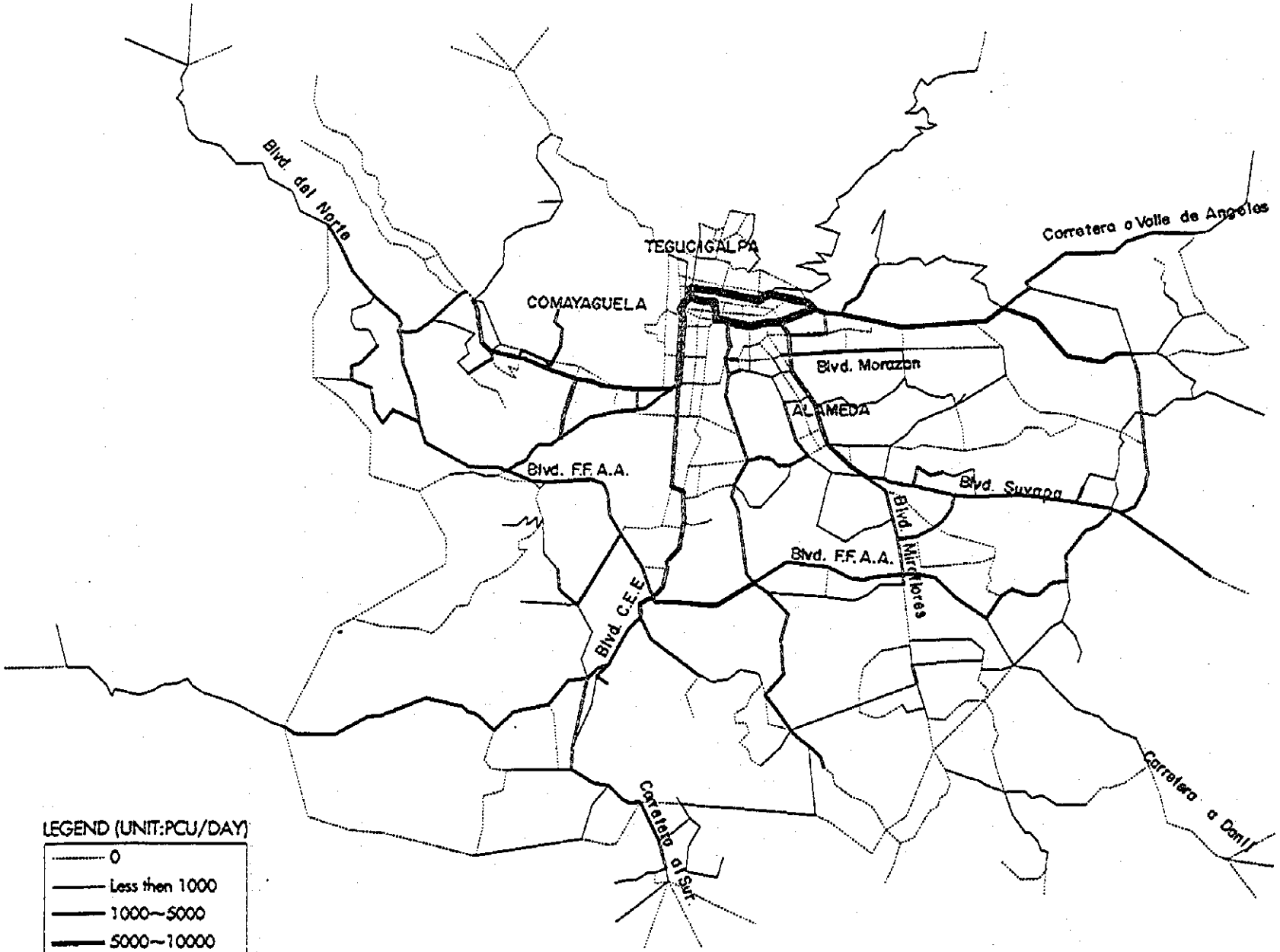


Fig. 10.7.1 The Future Public Transportation Demand in 2010

Table 10.7.1 Bus Passenger Demand in 1995 and 2010

Year	Item	Bus Demand
1995	Vehicle- km (x 1000)	105.2
	Passenger-km (x1000)	4,569.8
2010	Vehicle-km (x 1000)	256.7
	Passenger-km (x1000)	9,168.6
2010/1995	Growth Rate in Vehicle-km	2.44
2010/1995	Growth Rate in Passenger-km	2.01

The current bus system carries about 827,000 passengers/day by 1,558 bus units, operated mainly by S.T.U. Based on the present operational performance, it is estimated that the required number of bus units for 2010 will be about 2,000 units.

2) Taxi

Considering the demand increase in the future as shown in Table 10.7.2, it is necessary to strengthen the taxi system. Assuming that the growth rate is 1.56 and the operational performance of taxis remain at the current level, it is estimated that the number of taxis required in 2010 will be about 2,200 units.

Table 10.7.2 Taxi Passenger Demand in 1995 and 2010

Year	Item	Taxi Demand
1995	Vehicle-km (x 1000)	171.7
	Passenger-km (x1000)	435.6
2010	Vehicle-km (x 1000)	267.5
	Passenger-km (x1000)	680.7
2010/1995	Growth Rate in Vehicle-km	1.56
2010/1995	Growth Rate in Passenger-km	1.56

10.7.3 Future Public Transport System

1) Hierarchic structure of Public Transport

As new categories of buses, (1) interurban bus, (2) key route urban bus, (3) ordinary urban bus, (4) feeder urban bus are proposed.

(1) Interurban Bus

Interurban buses at present directly enter the CBD to various scattered terminals, causing the following problems:

- Traffic congestion
- Lack of integration of interurban buses and urban buses

The following system patterns have been reviewed:

① Centralized pattern
Present terminal is reorganized and relocated to new integrated terminals at city centers.

② Semi-Decentralized pattern
Present terminal is reorganized and relocated to new terminals at CBD boundaries.

③ Decentralized pattern
Present terminal is reorganized and relocated to new terminals at intersections between a trunk ring road and a trunk radial road in outside CBD.

Concerning above-mentioned pattern, alternative ③ is recommended by reasons of passengers' convenience, mitigation of traffic congestion and oversaturation in CBD. A decentralized pattern has following characteristics:

- Traffic congestion in CBD is alleviated.
- It is comparatively easy to obtain sufficient areas for new terminals, because the locations are away from CBD and the required area for each terminal is relatively small.

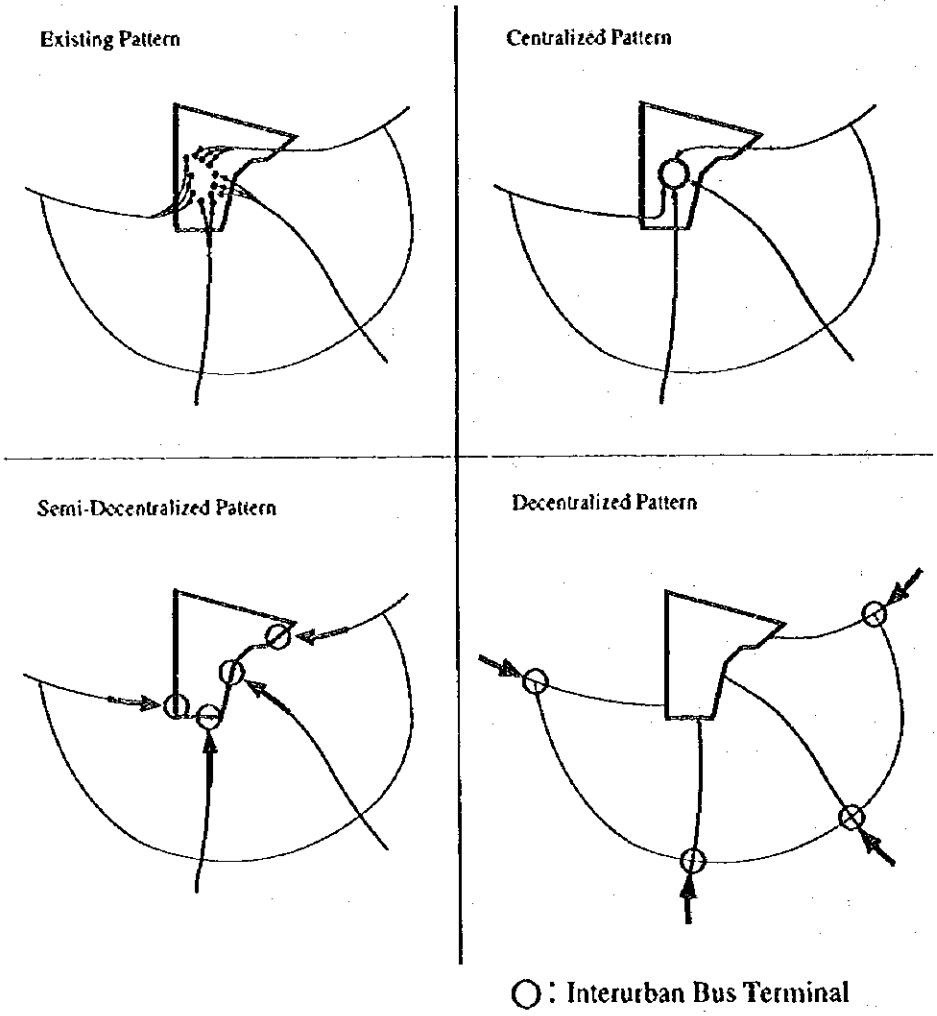


Fig. 10.7.2 Alternative Location Patterns of Interurban Bus Terminals

(2) Key-route urban bus

Key-route urban bus is operated on the trunk road connecting major origins and destinations. The basic issue of the key-route bus is to increase capacity and raise the service level while maintaining efficiency and alleviating traffic congestion along major routes. Out of urban bus routes, the trunk route which is mainly used in commuting be upgraded to this category. It is desirable that the key-route urban bus should have the following specifications:

- Large capacity (approximately 80 passengers)
- Fixed bus stops
- Improvement of transfer functions
- Priority measures such as bus ways, bus lanes, bus stops and bus terminals

The following pattern is an alternative to the concept concerning penetration of key-route buses into the CBD and location of transfer points.

① Separation of Route Inside and Outside CBD

- Outside routes do not enter into CBD.CBD has a separate system.
- Congestion in CBD can be alleviated by effective operation of the CBD system
- Most passengers need transfers to reach their destinations in CBD.
- Transfer functions are necessary on the CBD boundary , which tend to cause congestion around the locations.

② Penetration into Selected Roads in CBD

- The key route buses operate all through selected north-south and east-west roads in the center of the CBD
- The majority of passengers do not need transfers in CBD.

According to the above, alternative ② is recommended both for passengers' convenience and for traffic reasons.

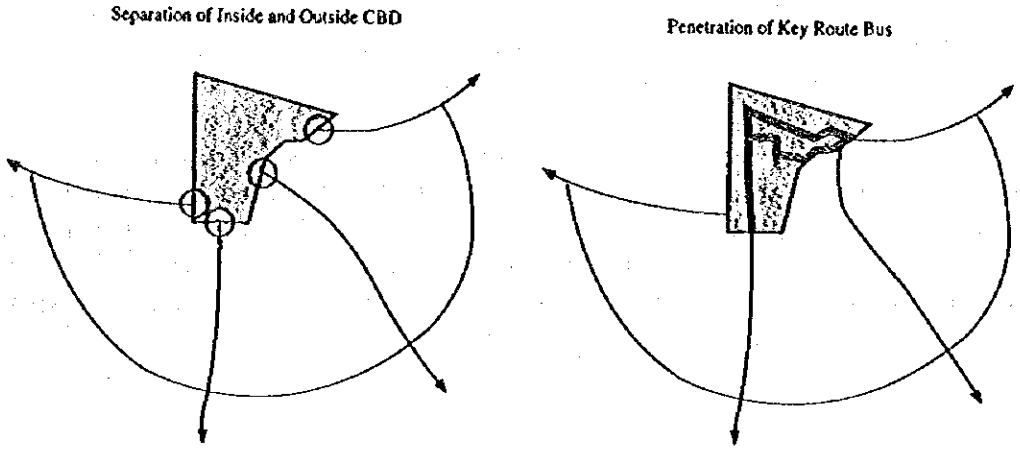


Fig.10.7.3 Alternative Patterns of Key Route Urban Bus Network

(3) Ordinary Urban Buses

Non-key routes are served by ordinary urban buses. Ordinary urban buses serve to connect minor origins and destinations and to feed passengers to key route urban buses.
In other words, they do not connect directly to the CBD. Most ordinary buses should have capacity of equal to or less than key route urban bus' capacity. They can share bus priority measures with key route urban buses along their routes.

(4) Feeder Urban Buses

The feeder service is a frequent service by micro-buses and taxis(fixed route) to feed passengers to key route urban buses and ordinary urban buses. The distance between bus stops is generally shorter than that of ordinary urban buses. Their service can be more flexible than higher category buses. For example, their stops can have flexibility such as in Zone Bus system, Route Deviation System. On the other hand, they should avoid arterial roads.

Concerning the fare system, the fare of feeder urban buses should be low. If passengers want to ride key route urban buses connected with the feeder urban buses, there is no need to pay for the feeder urban buses. They can share priority measures with connected key route urban buses.

(5) Restructure of bus route system

Fig.10.7.4 shows the restructure plan of bus routes system which is proposed following the hierarchic structure of buses. This plan is proposed to cope with the increasing future demand ,taking into account the following;

- Efficient bus operation ,such as operating frequency and route length
- Maximum use of the proposed exclusive bus road
- Assurance of services in areas where public transportation is poor, such as the rapidly developing suburban areas.

In addition, ordinary bus operation on radial roads is basically the same as key route buses except that bus size and navigation number are smaller, and cannot accommodate transfers with key-route buses. Ordinary buses on the middle ring road should be changed to key-route buses to better accommodate the greater number of passengers as well as route length. For this reason, the bus terminal for a transfer is proposed.

In the bus route network planning, allocation of routes, operating frequency, allocation of units etc. are studied. Since these study items are mutually related and a decision in each step has a wide degree of freedom, these require the source material, i.e., details such as a rate system, financial status of operators, opinion of users in order to propose an optimum system as the whole. In fact, the bus route network planning is frequently examined from experience in a point of view on financial status of operators.

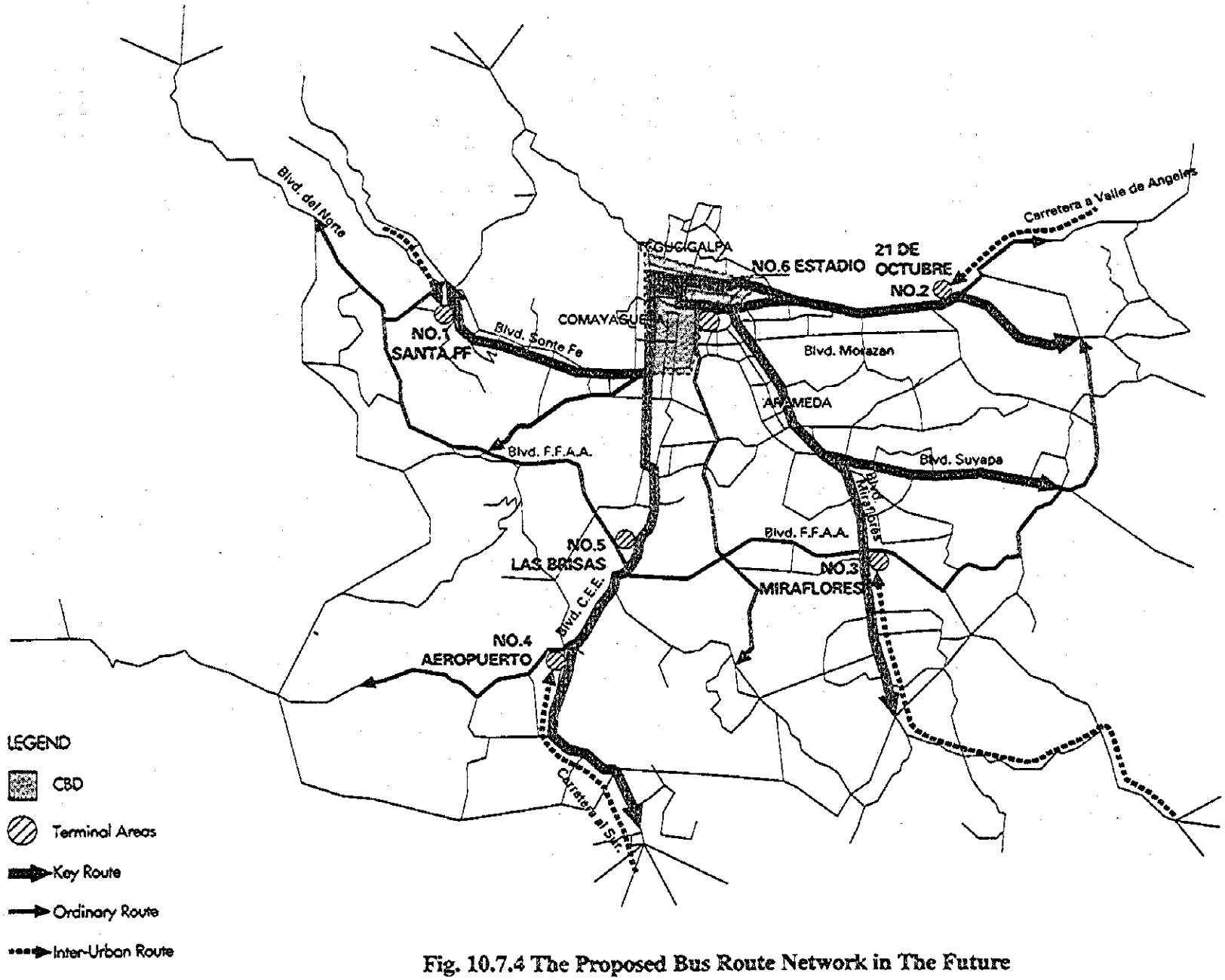


Fig. 10.7.4 The Proposed Bus Route Network in The Future

For this reason, the detailed bus route network plan should be examined by related organizations on the basis of future bus demand shown in Appendix 10.1, considering the following matters.

- Demand characteristics of each zone.
- Opinion of regional residents, and the route most convenient for them. This entails high operating frequency, transfers, and brief travel time to destination.
- High operating efficiency for bus operators. This entails total traveling distance of the total route and small number of bus units located on each route.
- Flexibility of route, for when the future OD demand changes.

Furthermore, regarding route-taxi service, if it is thought of as a necessity to complement poor bus service (overcrowded, slow, inconvenient), such types of taxis should change over to standard-type taxis in the event of future improvement of bus service.

(6) Recommendation for Future Bus Network System

The present bus route network is supposed to be "Many Route-Low Navigation Frequency Model" in which many routes concentrate in CBD and navigation frequency on each route is low, because routes have been added and extended in answer to urban development. "Few Routes/High Navigation Frequency" (i.e., reduction of route numbers, increment of navigation-per-route, and encouragement of en-route transfers) is a more advisable model.

It can be asserted that "Few Routes/High Navigation Frequency" is more desirable than "Many Routes/Low Navigation Frequency" from the viewpoint of both operators and users, with the exception that the number of en-route transfers will increase for bus passengers. Therefore, bus route network structure of the future should be examined on the basis of "Few Route-High Navigation Frequency Model".

Moreover, in order to handle popular resistance to the idea of increased transfers on the part of passengers, it is necessary to revise the rate system, i.e., through introduction of a discount rate for transferring passengers. In addition, development of bus terminals, introduction of new key-routes, a subsidary system for covering the bus deficit, etc., are necessary. As a matter of reference, the basic concepts of the rate system and subsidary systems in Japan are presented in Appendix 10.2.

In addition, so that bus stops do not cause traffic congestion, bus bays should be installed where possible and not face to face at the same point on the road.

10.7.4 Development of Bus Terminals

With the increased public transportation demand in the future, it is important to develop adequate facilities at the major terminals and transfer points.

Based on the bus network, as well as the traffic flow and volume of bus passengers, the transportation terminal areas, which would serve as interchanges, have been selected, as shown in Fig.10.7.4.

The characteristics and facility requirements of each area are summarized in Table 10.7.3. The details of estimated facility requirements are described in Section 11.4.

Table 10.7.3 Characteristics and Estimated Facility Requirement

No.	Name of Terminal	Interchange Pattern	D/A Passengers Demand	Facility Requirements (m^2)
1	Santa Fe	Interurban⇔Urban	6,900	4,020
2	21 de Octubre	Interurban⇔Urban	2,500	4,020
3	Miraflores	Interurban⇔Urban	2,200	4,020
4	Aeropuerto	Interurban⇔Urban	10,100	4,020
5	Las Brisas	Key Route⇔Ordinary	28,000	6,240
6	Estadio	Terminal Bus Center	74,900	12,030

The characteristics of the six terminal areas are described below:

(1) Santa Fé

This terminal functions as a connecting point for northbound interurban buses (San Pedro Sula, Comayagua, Olancho, etc.) with urban buses.

(2) 21 De Octubre

This terminal functions as a connecting point for east-bound interurban buses (Valle de Angeles, San Juancito, etc.) with urban buses.

(3) Miraflores

This terminal functions as a connecting point for southeast-bound interurban buses (El Zamorano,Danli,etc.) with urban buses.

(4) Aeropuerto

This terminal functions as a connecting point for south-bound interurban buses (Choluteca,Punta Raton,Nicaragua,El Salvador,etc.) with urban buses.

(5) Las Brisas

This terminal functions as a connecting point for north-south key route urban buses with ordinary urban buses along the Middle Ring Road.

(6) Estadio

This terminal becomes an origin and destination of urban buses. All urban buses which go through CBD arrive and depart from this terminal.

Concerning institutional aspects of the bus terminals, it is considered that the following types of organizations be in charge of the construction and/or management of the bus terminals

independently or jointly: that is, ① public institutions, ② semi-public corporation and/or ③ private sector.

10.8 Traffic Management Plan

The traffic management plan was examined based on the existing traffic conditions and problems anticipated occurring in the future.

10.8.1 Traffic Signal

1) Necessity of Periodical Inspection

The traffic signals installed in the study area seem to be somewhat old, therefore, at some intersections the traffic signals do not function well (e.g., at the intersection of Boulevard Comunidad Europea and Salida a la Represa Concepción). Periodical inspection and maintenance of the traffic signals are required.

2) Installation of traffic signals

There are some unsignalized intersections with rather heavy traffic volume. At these intersections traffic policemen are handling the traffic sometimes, especially, during peak hours (e.g., at the intersection of Subida al Estudio National and the circular road of the national stadium, intersection of Boulevard José Cecilio del Valle and Calle Golan, etc.). When there are no traffic policemen, the traffic flow at these intersections become disorderly. At these intersection it is recommended that traffic signals be installed. At the following intersections traffic signals should be required;

- Intersection of Comunidad Europea and Salida al Puente El Prade
- Intersection of Boulevard José Cecilio del Valle and Calle Golan
- Intersection of Subida al Estadio Nacional and the circulation road of the National Stadium
- Intersection of Boulevard Santa Fé and Carretera a Olancho
- Intersection of Boulevard Santa Fé and Carretera del Norte
- Intersection of Calle 9 crossing Avenidas in the central area of Comayagüela

Currently, on Calle 9 in the center of Comayagüela there are nine intersections. Among these intersections four intersections have already installed traffic signals. According to the results of intersection survey, more than 50 % of vehicles passing on Calle 9 are going straight. In this case the close relationship is necessary between traffic signals to handle the heavy traffic. Therefore, the introduction of a coordinated signal system is recommended at the intersections of Calle 9 in the center of Comayagüela.

10.8.2 Traffic Signs

1) Regulatory signs, directional signs and informative signs

Many unsignalized intersections have no regulatory signs and/or directional signs showing which is a preference road and whether drivers should make their cars come to a full stop to confirm the traffic safety. These signs are indispensable for keeping traffic laws and rules for the safety. These traffic signs are recommended to be installed not only at major intersections but also at smaller

intersections. As for the informative signs, their installation has been carried out by the municipality along major roads. It is desired that this effort be to continued.

2) Road marking

In the study area road markings are not drawn except on some sections of major roads. Since this marking was drawn by ordinary paint (as opposed to hot paint), it is almost worn out. It is important to make markings (lane mark, stop line, etc.) and keep them clear since they make traffic flow smoother and road capacity is increased, making the driving much easier.

10.8.3 Measures for the central area of Tegucigalpa

1) Parking in the central area in the Central Area of Tegucigalpa

As mentioned in Section 5.10, the total capacity of parking lots in the central area of Tegucigalpa 2,840 vehicles and the present parking demand is estimated 6,050 vehicles, which means the parking space of one vehicle is used 2.13 times. On the other hand, there are many vehicles which park on congested roads illegally; estimated at 1,968 vehicles per day. According to the future traffic demand in the central area of Tegucigalpa, the future traffic demand in this area is not estimated to increase so much from the present level (the trips is target year by vehicles generating from and attracted to the central area of Tegucigalpa is only 1.3 times, compared with the existing level). Considering the heavy traffic congestion, illegal on-road parking should be strictly controlled. The parking survey conducted by the study team showed about 948 vehicles parked on roads within the central area of Tegucigalpa. Therefore, in order to accommodate these on-road parking cars, it is necessary to provide parking lots with total capacity of 492 vehicles (982/2.13). Considering the future traffic demand (2010), the parking capacity of about 640 vehicles would be needed(492 x 1.3).

In the proposed Master Plan, the passage of the private cars becomes inefficient by introducing the exclusive bus way and the community road. Therefore, the new construction of the parking lots inside the central area should be restricted Parking lots should be constructed outside of the central area of Tegucigalpa. The recommended parking places are as follows; locations are shown in Fig. 10.8.1.

① Place near Puente el Chile
② Place near Puente Carias
③ Place near Puente San Rafael
④ Place near Puente Guanacaste

At these places the parking capacity with 160 vehicles is necessary. Among these four places a parking lot near Puente San Rafael should be constructed, as the land is already owned by the Municipality. A parking lot near Puente Carias should begin construction work just after the wholesale market will transferred to the southern part of the Toncontine airport according to the suggestion in this Master Plan.

As for the central area of Comayagüela, there is no problem for the on-road parking, because there is some room to park vehicles on roads on some Calles and Aenidad in Comayagüela. It takes for granted that the o-road parking should follow the regulation by the Municipality.

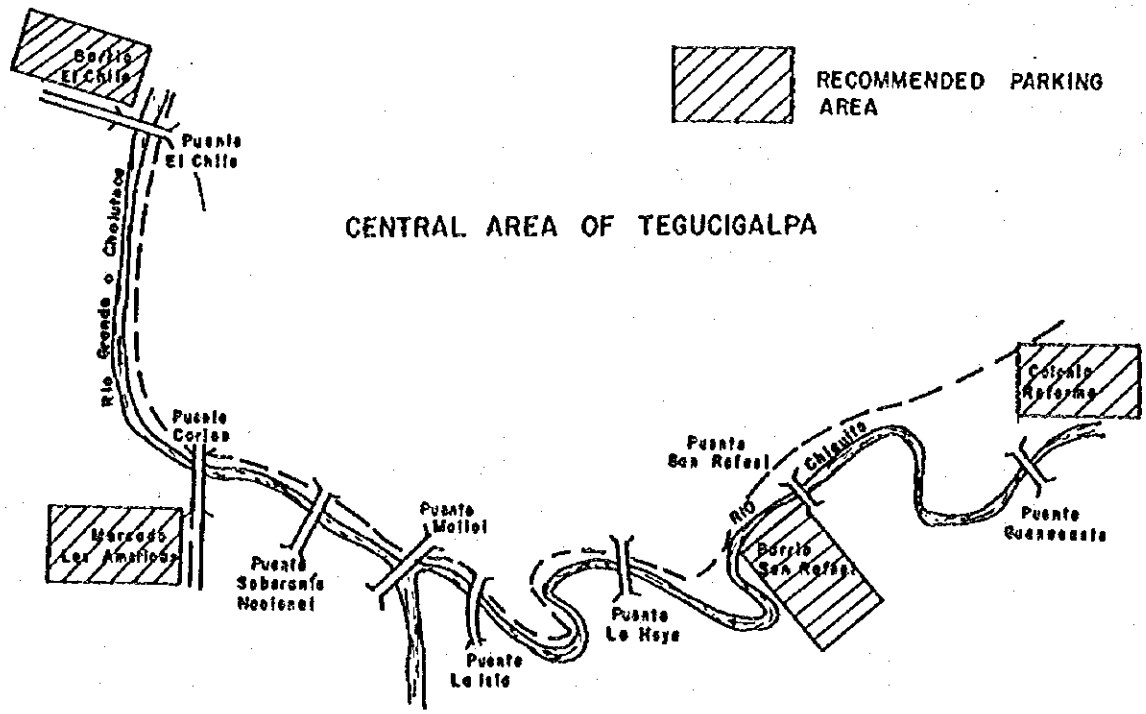


Fig. 10.8.1 Recommended Parking Places

3) Introduction of Bus Way and Pedestrian way

(1) Bus Way

By prohibiting the passage of private cars, traffic congestion can be eliminated. As a result, the movement of pedestrian and the public transportation can move much more smoothly. Usually, urban buses are involved in traffic congestion, which results in inefficient bus operation. By securing exclusive bus ways in the congested area, the operation of public transportation can be considerably improved. The merit of the introduction of the bus way is as follows:

① Operation time can be saved.
② Operation schedule can become more punctual.
③ Passengers can save the travel time.
④ The bus network can be reorganized according to bus demand.

In this Master Plan, the introduction of the exclusive bus way is proposed along the whole section of Avenidad Cristobal Colon and the section from Calle Molleros to Calle Salvador Mendiente in the central area of Tegucugalpa. In addition, on Avenida 6 in Comayagüela and Boulevard Santa Fé, the most congested existing main bus roads, an exclusive bus lane is introduced. The location of the bus exclusive way and bus exclusive lane is shown in Fig.

10.5.1 (2). With the introduction of the bus ways and bus lanes, the bus route is reorganized (explained in Section 10.7 in more detail).

(2) Pedestrian Way

As explained in 10.2, the Municipality of Tegucigalpa has already decided to reorganize the central area of Tegucigalpa (Centro) as a district of historical, cultural, touristic and recreational district. For this purpose the Centro area should be changed so as to attract many people, not only Hondurans but also foreigners. At the present the Centro area is not a place comfortable or safe for visitors. As mentioned above, the bus way in the Centro takes a role of the so-called "Transit Mall". In addition, on the section of Avenidad between Plaza Francisco Morazán and Puente San Rafael, the "community road" is introduced, mainly to attract tourists. These transit malls and community roads promote the attractiveness of this area because pedestrians can walk comfortably and safely while enjoying shopping , dining, relaxing, etc. The sketch design of the community road is shown in Fig. 10.8.2.

(3) One-Way System in the Central Area of Tegucigalpa

In the central areas of Tegucigalpa and Comyagüela, the one-way system has already been introduced. In Comayagüela the existing one-way system is judged to have almost no systematic problems, considering the existing and future traffic flow. However, review of the one-way system in the central area of Tegucigalpa is necessary, because the of the proposal of bus ways. At present buses are mainly running from the west to the east on Avenida Cristobal Colon and from the east to the west on Avenida Miguel de Cervantes. Along the section of Avenida Cristobal Colon and the section from Calle Molleros to Calle Salvador Mendiente, the bus way is planned to be introduced in the proposed Master Plan. In this Master Plan the buses are supposed to run from the east to the west on Avenida Cristobal Colon and from the west to the east on Avenida Miguel de Cervantes, considering the convenience of using the urban bus terminal (also proposed in the Master Plan) on Calle la Isla near the National Stadium. According to this change of the running direction of buses, the one way system was reviewed completely on the other Avenidas and Calles in the central area of Tegucigalpa. This proposed new one-way system is shown in Fig. 10.8.3. Although this new one-way system was changed through discussion with the counterparts of the METROPLAN, it is recommended to improve the system on the basis of the result of the actual implementation through trial and error.

(4) Examination of Introduction of Zone System

The best way of mitigating traffic congestion is to control the entrance of vehicles into the congested area. This measure is called the "Zone System", which can exclude the through-traffic, secure the safe and comfortable passage of pedestrians, enhance the convenience of public transportation, and vitalize various activities in the Centro area. This zone system has already introduced into some cities and towns throughout the world.

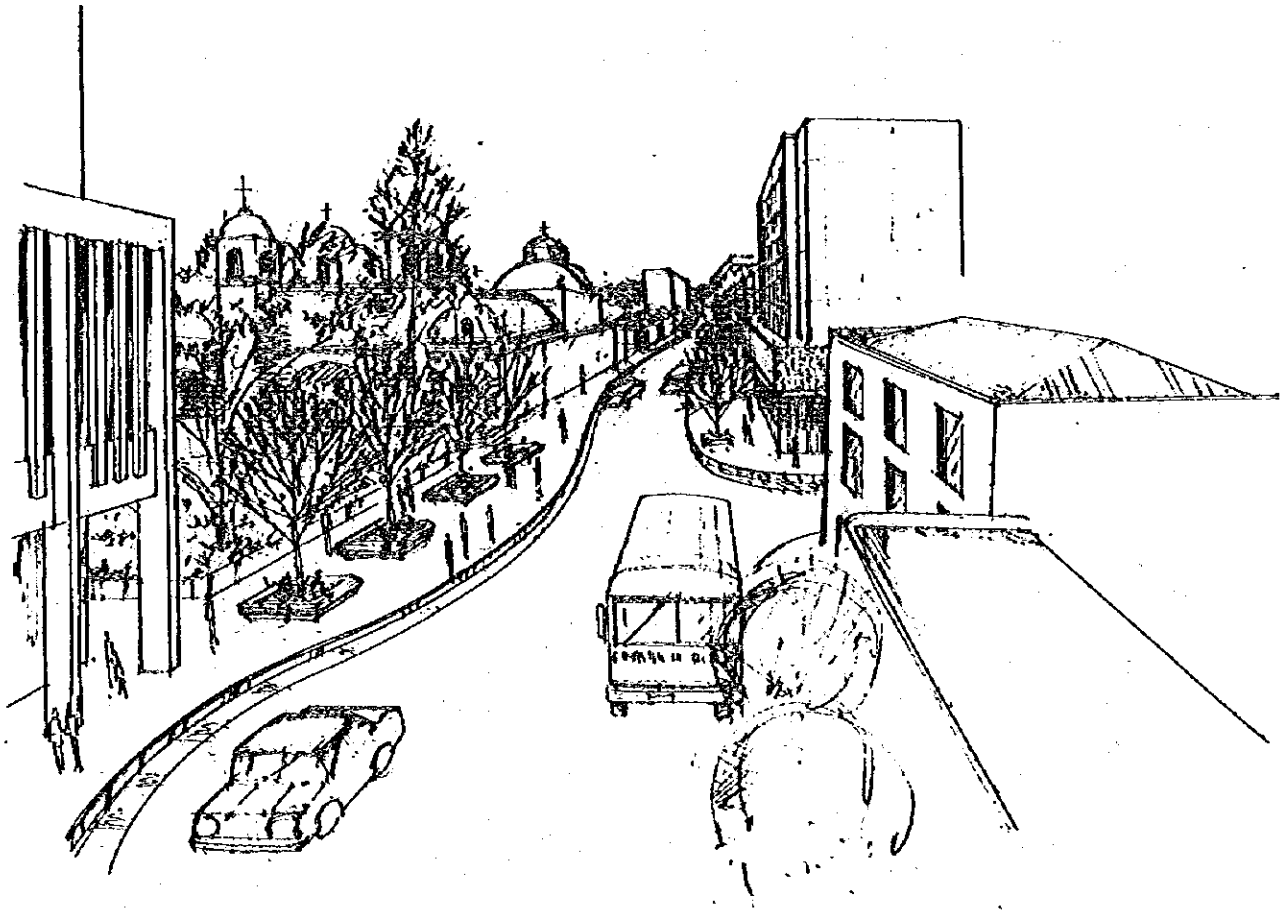


Fig. 10.8.2 Sketch of the Community Road

Judging from the geographical point of view, the central area of Tegucigalpa is considered to be a suitable place to be apply this system, because this Centro area is surrounded by Choluteca River, Chiquito River and mountains, which make it easy to control the influx of vehicles at bridges crossing these rivers. However, the actual implementation is not so easy. There are several questions to be answered:

① Can the security of citizens from social problems such as robber, kidnapping, etc., be guaranteed in the absence of automobile use?
② Should a toll system be adopted for entering the restricted area?
③ Are the public parking lots supplied sufficiently just outside the restricted area?
④ Which cars are regulated entrance to the restricted area?

At the moment, discussion on this theme has been made among some members of Comité Vial. However, judging from the present situation of public security, the introduction of this zone system is considered to be difficult. In addition, as proposed in this Master Plan, if bus ways and community roads are introduced as a implementation of the "traffic calming policy", the traffic congestion in the central area of Tegucigalpa (Centro area) will be reduced, especially on main roads such as Avenidad Miguelde Cervantes and Avenidad Cristobal Colon. However, since it is certain that the zone system has the significant effect on the decrease of the traffic congestion, the introduction of this system is expected in the future , if the above-mentioned problems can be resolved.

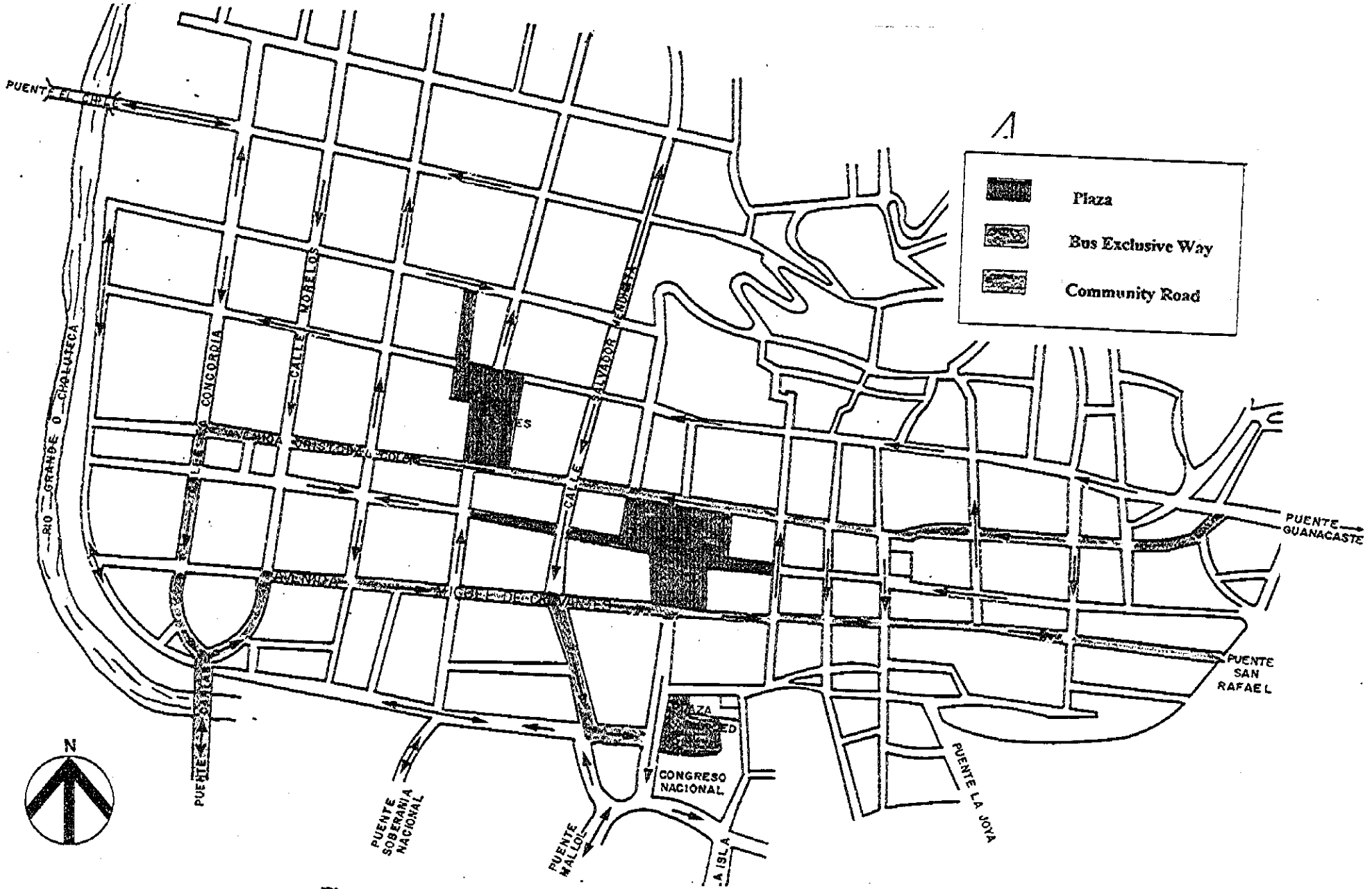


Fig. 10.8.3 Proposed One Way System in the Central Area of Tegucigalpa

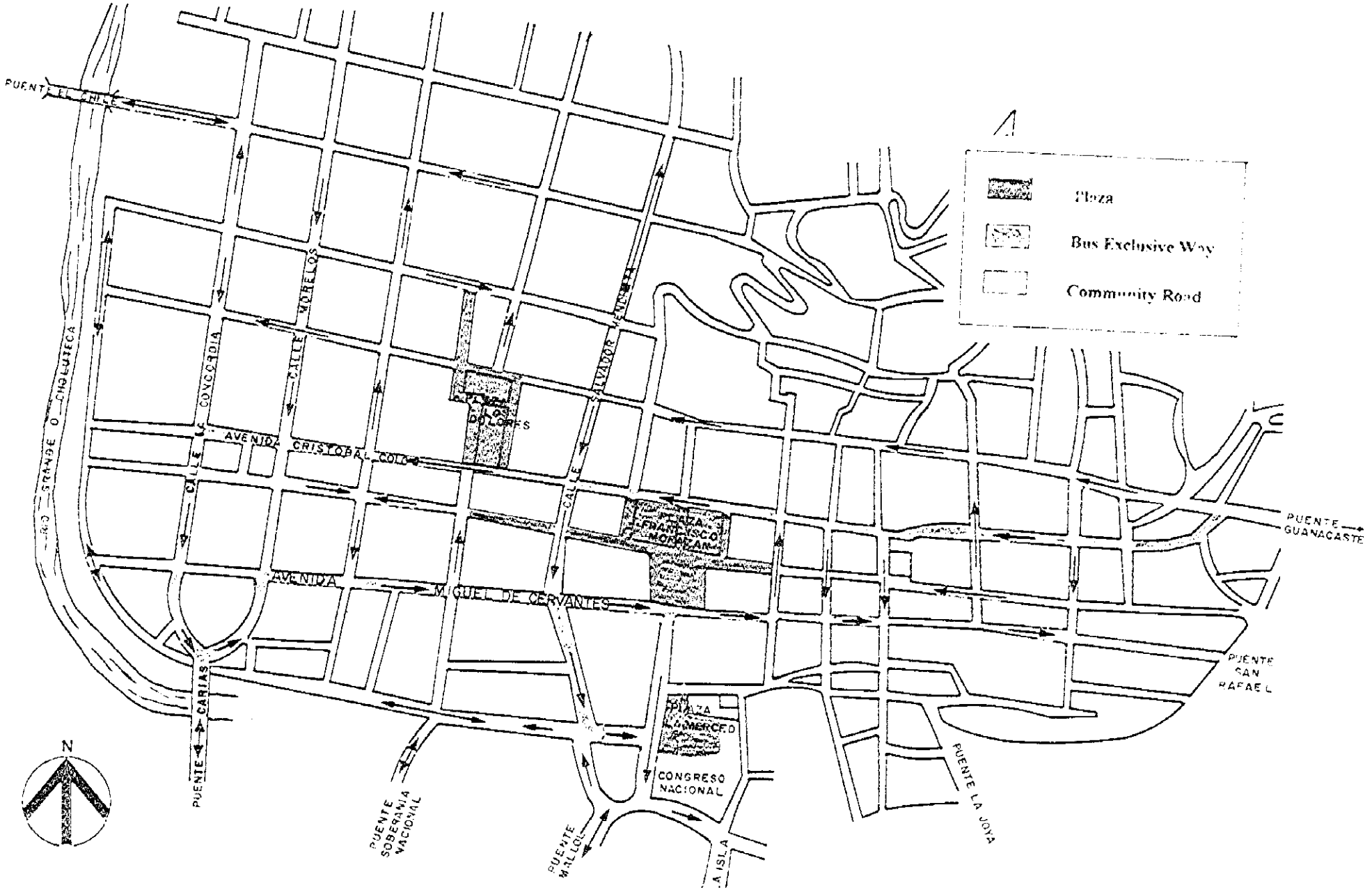


Fig. 10.8.3 Proposed One Way System in the Central Area of Tegucigalpa

CHAPTER 11

PRELIMINARY DESIGN AND COST ESTIMATION

CHAPTER 11 PRELIMINARY DESIGN AND COST ESTIMATION

11.1 General Description

This chapter describes the results of preliminary design prepared for the proposed projects and covers the following:

- Road design
- Structural design
- Bus terminal design
- Cost estimation
- Construction plan

11.2 Road Design

11.2.1 Road Design Policies

Basic road design policies are as follows;

- In improvement sections of existing road, proposed vertical and horizontal alignment are planned based on the height of existing road surface and alignment of existing road to decrease construction cost and to mitigate adverse social and environmental impact. Resettlement, preservation of cultural facilities and natural conditions are to be considered.

- In new road sections, the horizontal alignment is set in a way to avoid residences when possible.

11.2.2 Geometric Design Standard

Geometric design standard for road design is applied the Central American Standard(see in Table 2.2.5). AASHTO is referred to where design standards are lacking.

Since proposed roads in the Study are ordinary class in this standard, preliminary road design is carried out applying the design criteria in Table 11.2.1.

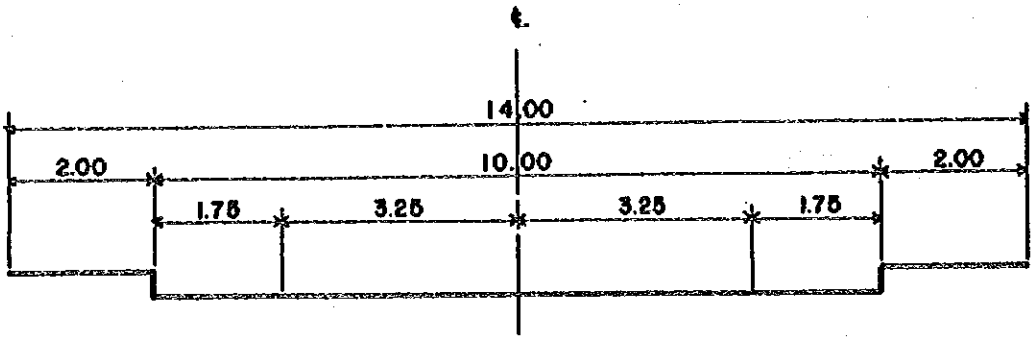
Table 11.2.1 Summary of Design Criterias

Item	Unit	Design
Design Speed	kph	40
Minimum Vertical Curve Length	%	8 (9)
Minimum Vertical Curve Radii	m	50
Minimum Horizontal Alignment	m	450
Width of Carriageway	m	3.25
Width of Shoulder	m	1.75

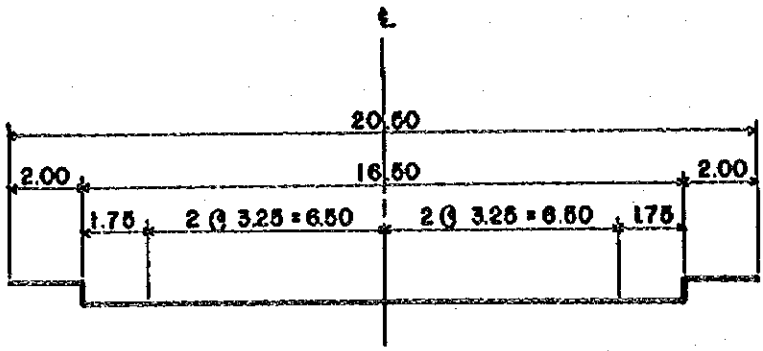
11.2.3 Cross-Section Design

(1) Typical Cross Section

Typical cross sections of 2-lane and 4-lane roads are shown in Fig. 11.2.1. Their typical cross-sections are applied for roads and bridges.



2 Lanes Road



4 Lane Road

Fig. 11.2.1 Typical Cross Section

(2) Side Slope

Side slope in cut section of soil area generally adopts a ratio of 1:1.0 and in high cut section the beam is located maximum height 7m intervals as shown in Fig. 11.2.2.
Side slope in embankment section generally adopts a ratio of 1:1.5 and in high embankment section the beam is located at a maximum height of 5m intervals as shown in Fig. 11.2.2.

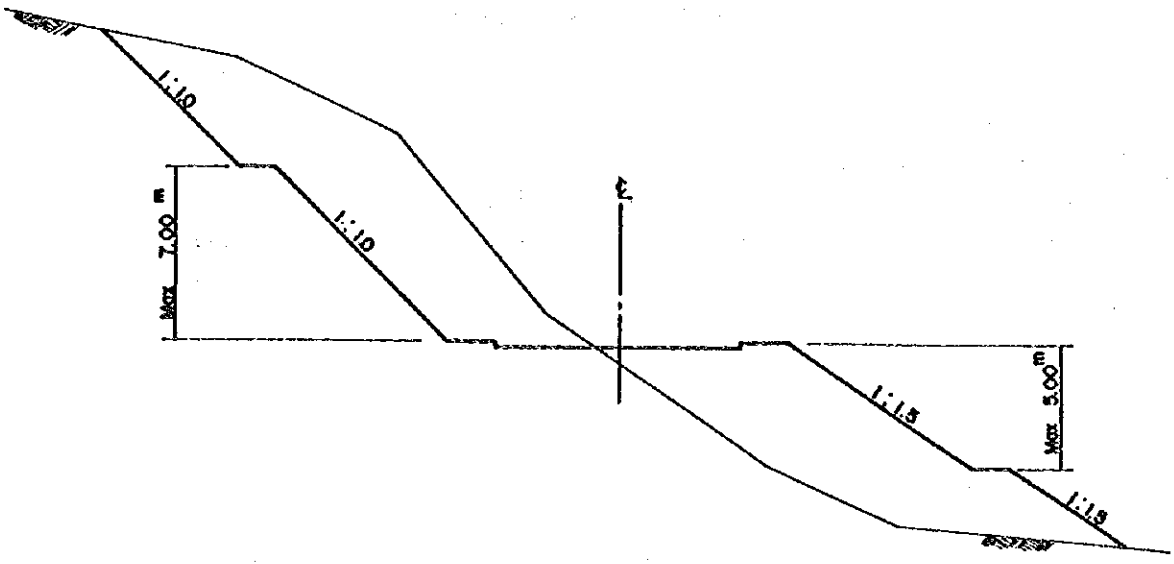


Fig. 11.2.2 Typical Gradient of Side Slope

(3) Right of Way

Right-of-way of ordinary class road is a total of 30m. However, right-of-way in this study is the edge of sidewalk in urban area and is 2m from edge or top of slope in suburb an area.

11.3 Structure Design

11.3.1 Overview of Structure Planning

1) Design standard

The structure design standard in Honduras follows AASHTO specifications. Design load to be applied is HS20-44.

2)Adoption of Concrete Bridges

Concrete bridges will be adopted for the Project for the following reasons:

-Presently standard bridge type in Honduras,
-Durability of concrete structure,
-Lower initial and maintenance costs
(Steel girder is imported material and expensive in Honduras),
-Utilization of local labors and procurement of materials such as cement, reinforcing steel and aggregates is possible locally,
-Bridge aesthetics; and,
-Underpass(Box-Culvert) has high initial and maintenance costs

3) General Description Bridge Types

(a) Superstructure

The superstructure should be designed to meet the following general requirements.

Structural Requirements
The general relationship between span length and bridge type is shown in Fig.11.3.1. The minimum span length of a bridge is generally determined by the nature of the rivers or roads over which the bridge is required to pass: the soil condition, and factors relating to the surroundings. The span length is one of the most important factors in determining the bridge type. Once the span length is fixed then the choice of bridge type is limited.

A beam has a desirable ratio of depth to the length of span which will result in minimum construction cost, and this depth ratio is generally adopted.

However, for the span length of a bridge where the depth is critical for determining the vertical alignment of the road which will affect the total cost of the structure, the minimum depth is adopted.

Environmental Requirements
Careful considerations are necessary to preserve the existing environment of man-made facilities(e.g., public facilities such as road network) and to avoid adverse effect to existing rivers. From the aesthetic point of view, a bridge type which harmonizes with the surrounding environment should be adopted.

Construction Requirement

The precast method(Construction method will be truck crane erection) is an effective way to shorten the construction period. If the construction period is limited, the type of bridge is determined by taking into account the speed of construction.

Construction Economy

The most economical type of bridge will ultimately be selected from the alternatives which satisfy the conditions mentioned above. To compare the costs of various bridge types, the total construction costs of the superstructure, substructure and approaches will be considered.

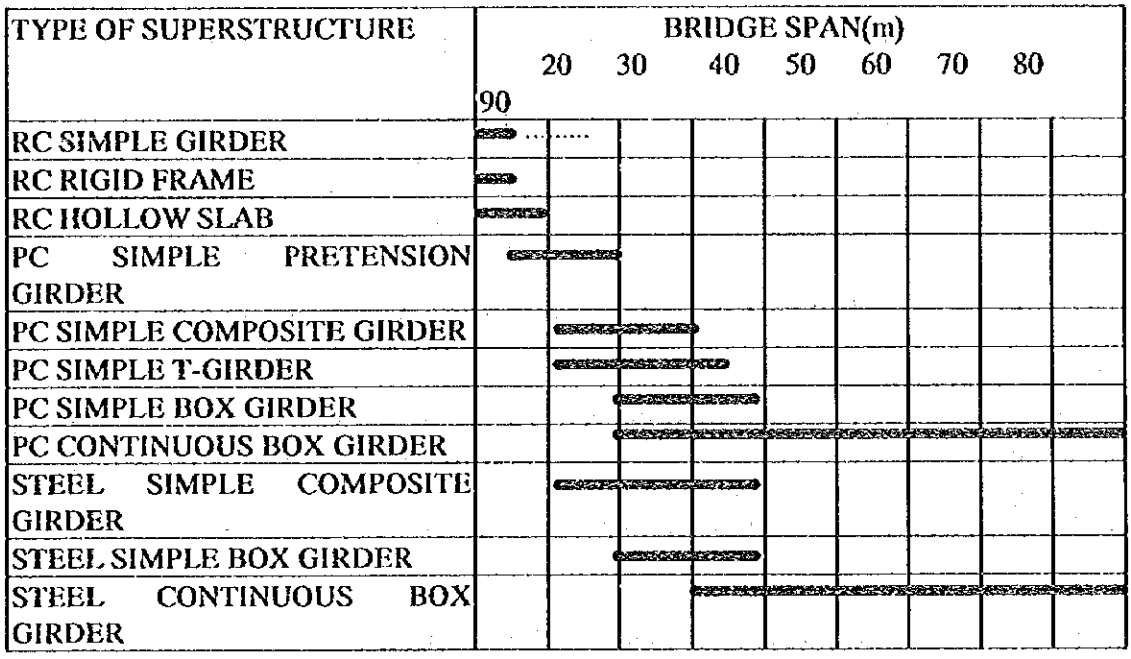


Fig.11.3.1 Standard Spans for Various Types of Bridge

(b) Substructure

The substructure of bridges should be designed to meet the following general requirements.

Abutment

Reinforced concrete will be used for abutments. In general the type of abutment is determined based on the relationship between height and the suitability of abutment type as shown in Fig.11.3.2.

ABUTMENT TYPE	HEIGHT(M) 10 20 30	REMARKS
GRAVITY TYPE		H
SEMI GRAVITY TYPE		
REVERSED T TYPE		
BUTTRESS TYPE		
RIGID FRAME TYPE		
BOX TYPE		

Fig.11.3.2 Range of Heights for Various Type of Abutment

Pier

Reinforced concrete piers will generally be used unless special conditions must be met. The appearance of the piers is an important factor in determining which type should be used, especially for viaduct in urbanized areas.

Wall type pier is recommended for river piers to provide smooth flow of water at the piers.

Types of Foundation

The foundation type is determined mainly by subsoil conditions, the loading to be supported and economic criteria. Generally, a spread foundation is used where the depth of the supporting strata is less than 5m, whereas a piled foundation is employed for depths of more than 5m.

11.3.2 Preliminary Design of Bridges

This subsection describes the results of preliminary design of bridges.

1) General

As a result of overview of structure planning in the previous subsection, it was found that a total of 10 bridges are to be involved in the new construction.

2) Basic Policy for the Determination of Total Bridge Length and Span Arrangement

(a) River Bridges

-Abutments of bridges which cross rivers must be located away from the dikes to prevent weakening of dike body;

-Bridge length of river crossings with no dikes should be determined to take the river width in flooding condition into account; and

-The minimum span length of river bridges should be determined to limit obstruction by piers during flooding to approximately 5% of the sectional area of the river. The minimum span length of 25m was determined from the above point of view. Also, from an aesthetic point of view, span lengths should be as constant with each other as possible.

(b) Viaduct

-The ends of viaduct should be determined considering the limitation of maximum embankment height; and
-The span arrangement for viaducts should be determined taking into account the existing and future width of the road.
-Structure type of grade separation plan for 2 intersections in Project 6-1 is considered as shown in Table 11.3.1. As result of consideration, viaduct structure type is selected.

3) Superstructure Design

According to the policies of the determination of total bridge length and span arrangement and maximum standard span length in Honduras, a maximum span length of 30m was determined. Based on the relationship between span length and standard type of bridge the study team selected the following superstructure types for various span lengths.(Table 11.3.2)

Table 11.3.2 Superstructure Types by Span Length

Span Length(m)	Superstructure Type	Remarks
L<25	RC I-Girder	
25≦L≦30	PC I-Girder	Post-tension system

A simple girder type has been adopted for all bridges considering ease of construction, construction economy and minimization of construction period.

4) Substructure Design

(a) Abutments

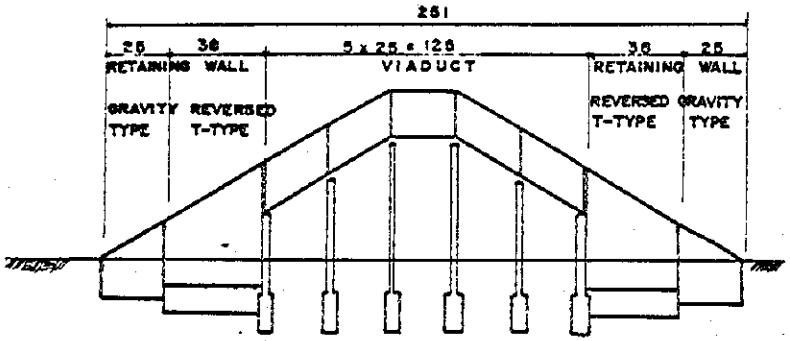
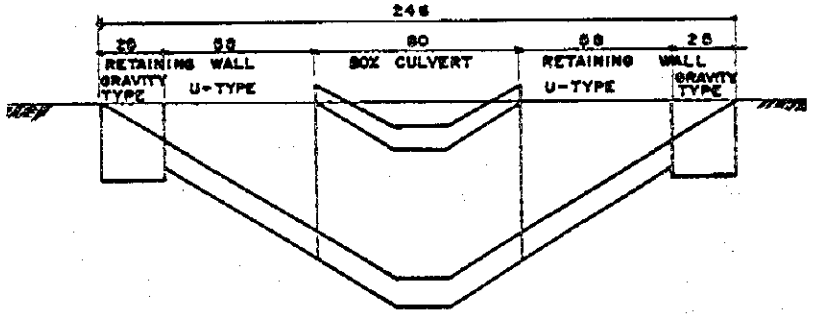
The height of abutments generally ranges from 7m to 12m. Masonry gravity type is currently constructed in Honduras. However as a result of hearing it was found that this type is more expensive than concrete gravity and RC reversed T type. Therefore, the adoption of the following types of abutment is recommended.(Table 11.3.3)

Table 11.3.3 Abutment Type by Its Height

Abutment Height(m)	Abutment type
H≦6	Concrete Gravity Type
6<H≦12	RC Reversed T Type

Wing walls and approach slabs are required in many cases. It is assumed that the wing wall length is limited to about 8m and the approach slabs are provided where the embankment height

Table 11.3.1 Comparison of Overpass and Underpass

	Alternative-1 Overpass(Viaduct)	Alternative -2 Underpass(Box Culvert)
Sketch		
Structural Aspect	-past construction record of this type are plentiful -superstructure type; PC composite girder(post-tension system) -this alternative has viaduct and reversed T type retaining wall for approach	-no past construction record of this type -this alternative has box culvert, half-underground structure and retaining wall -countermeasure of uplift depending on ground water
Construction Aspect	-erection method; truck crane or steel girder erection, construction is easy -reconstruction of river protection at pier foundation -neighboring construction with building -detour road during footing construction	-existing road will be closed -technical transfer will be required -necessity of cofferdam, neighboring construction with building -reconstruction of river protection along the new road
Maintenance Aspect	-maintenance-free	-past flood level over the road, existing river condition does not change -necessity of pump facilities for drainage -necessity of lighting facilities -routine inspection will be required
Environmental Impact	-not in harmony with surroundings	-in harmony with the surroundings -concentration of air pollution at the entrance of box culvert
Economical Aspect	-initial cost less than Alternative-2(approximately 8%) -maintenance cost less than Alternative-2	-high initial cost -high maintenance cost
Evaluation	-this alternative is more favorable than Alternative-2	-this alternative has several problems to be solved

is more than 5m.

(b) Piers

-Piers in Rivers
The wall type is adopted for piers in rivers to provide smooth flow of water.

-Piers for Viaducts
The rigid frame type and T type are adopted for viaduct piers for economic reasons.

5) Foundation Design

(a) General

According to the results of soil investigation carried out by SECOPT's Feasibility Study and the information of the Soil Department in SECOPT, spread foundations are required. (Appendix 11.1)

(b) Minimum Cover Depth of Footings

Pier and abutment footings will be provided with appropriate soil covers depending on their situations. In the case of piers in rivers, a minimum cover depth of 2m is considered to be sufficient to take account of possible scouring. In the case of piers for viaducts, a minimum cover depth of 1m is considered adequate to take the construction of drainage facilities into account.

11.3.3.Summary of Major Bridges

Design features of major bridges are summarized in Table 11.3.4.

Table 11.3.4 Summary of Main Bridges

	No1	No2	No3	No4	No5	No6
	Project 6-2 Middle Term	Project 6-1 Long Term	Project 8 Short Term	Project 11-1 Short Term	Project 11-2 Middle Term	Project 15 Long Term
Bridge Length	410m	100m	125m	120m	60m	100m
Span Length	5*25+30+7*25+30+2*25	4*25	5*25	4*30	2*30	4*25
Superstructure Type	PC I-Girder Post-tension System	PC I-Girder Post-tension System	PC I-Girder Post-tension System	PC I-Girder Post-tension System	PC I-Girder Post-tension System	PC I-Girder Post-tension System
Pier Type	T Type	Rigid Frame Type	Wall Type	Wall Type	Wall Type	Rigid Frame Type
Pier Height	7.0-11.5m	8.5-12.0m	9.0-13.5m	8.5-10.5m	10.5m	13.0-14.0m
Abutment Type	RC Reversed T Type	RC Reversed T Type	RC Reversed T Type	RC Reversed T Type	RC Reversed T Type	RC Reversed T Type
Abutment Height	9.0m	7.5,8.0m	8.0,9.0m	7.0m	12m	12m
Crossing Over Facilities	Sa Ave. Ave. Juan Roman Molina	small canal	Rio Grande o Choluteca	Rio Guacerique	Boulevard Fuerzas Armadas Road	
Remarks	*along the right bank of the Rio Grande o Choluteca *to be constructed along riverbank protective wall *reconstruction of river protection	* near houses *inclined ground	*minimal thickness of slab concrete depending on vertical curve *piers arranged to avoid center of flow	*near curve of river *cross obliquely over the river	*guarding sight distance *pier located at middle of median	*inclined ground

11.4 Urban Facilities Design

11.4.1 Bus Terminal

(1) Planning Conditions

1) Requirement functions

The proposed bus terminal areas should be redeveloped to have the following functions.

- Berth, Concourse, Roadway, Parking
- Operation Facility
- Commercial Facility, etc.

2) Layout Plan

The layout of berth is a saw shape model by interurban bus terminals,a parallel model by urban bus terminals.

3) Design Conditions

- Roadway Width : More than 6.5 m both ways, More than 3.5m one way
- Minimum Radii : More than 12m
- Parking Lot : Length more than 12m, Width more than 3m. Parking lot is boxed by marking
- Platform : Width more than 0.8m. Height of sudden change of level more than 0.1m and less than 0.2m

4) Method for estimation of the number of necessary berth

The number of necessary berths is estimated by following expression.

$$NB = \{(DM / AP) \times PHF\} / MC$$

NB : Number of Berths
DM: Number of Passengers Boarding and Disembarking (persons/day)
AP : Average Number of Passengers (persons/unit)
PHF : Peak Hour Factor
MC : Maximum Capacity of Berth (vehicles/hour)

Here, each value is set as following;

AP = 50 persons/unit ,based on the bus passenger survey
PHF = 0.12 in CBD , 0.08 outside CBD, based on bus volume survey
MC = 10 buses/hour, based on the following;
necessary time for boarding = 3 sec/person,
necessary time for disembarking = 2 sec/person,
total necessary time for disembarking and boarding of all passengers =5 min.
(50 persons × 3 sec+50 persons × 2 sec=250sec, with leeway, estimated at 5 min.),
therefore, MC = 60 min. / 5 min. = 12, considering moving time for bus rotation, estimate MC at 10 buses / hour

The number of necessary berths is roughly estimated on the basis on the above method,

considering the number of bus routes. If the number of berths is calculated to be less than Minimum Number of Berth(2 ~ 4 Berths), the number of berths should be estimated at Minimum Number of Berths (2 ~ 4 Berths).

(2) Preliminary Design of Bus Terminals

Preliminary design of bus terminals was conducted on the basis of the above conditions. According to the results of preliminary design, design features of each bus terminal are summarized in Table 11.4.1.

Table 11.4.1 Design Features of Bus Terminals

No.	Name of Terminal	D/A Passengers (persons/day)	Necessary Number of Berths	Layout Type	Facility Requirements (m^2)
1	Santa Fe	6,900	3	S	4,020
2	21 De Octubre	2,500	2	S	4,020
3	Miraflores	2,200	2	S	4,020
4	Aeropuerto	10,100	4	S	4,020
5	Las Brisas	28,000	6	P	6,240
6	Estadio	74,900	20	P	12,030

Note : S ; Saw Shape Model P ; Parallel Model

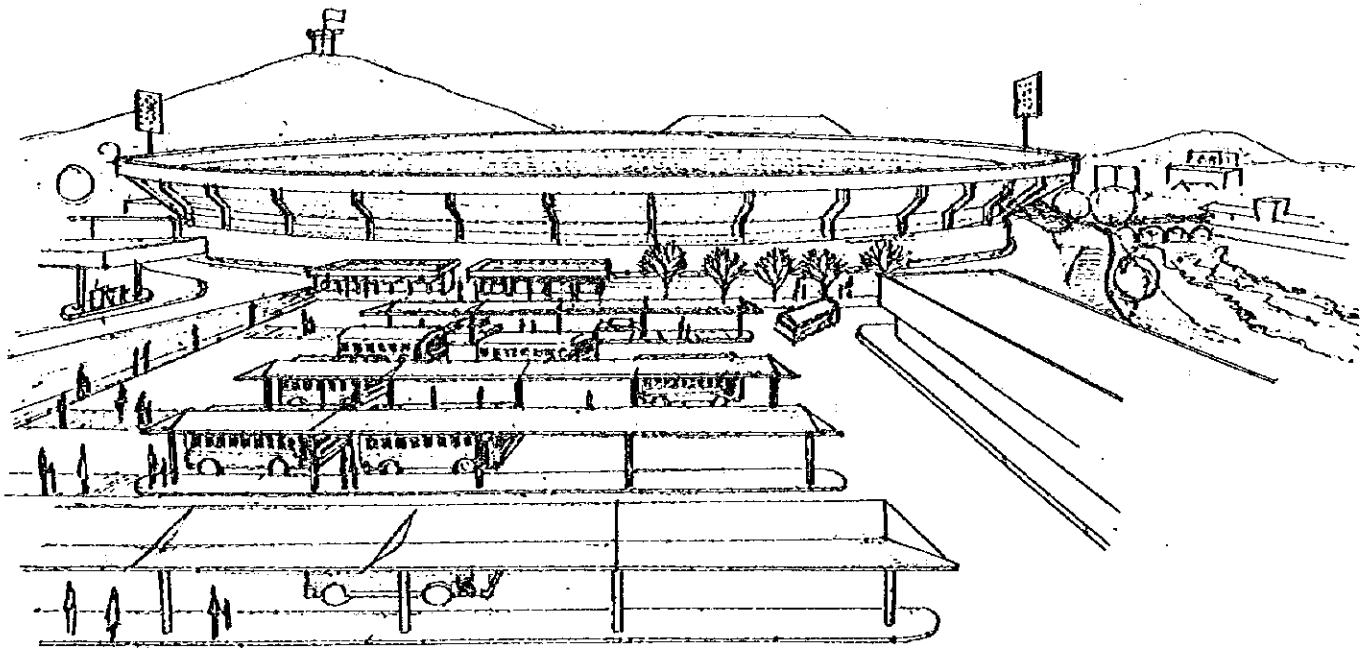


Fig.11.4.1 Perspective of Bus Terminal (Estadio)

11.4.2 Truck Terminal

(1) Planning Conditions

The truck terminal is generally planned on the basis of the designed daily freight volume. The designed daily freight volume in the proposed truck terminal is estimated as 10,000 tons/day. The proposed truck terminal is designed under the following conditions.

- Necessary Number of Berths : 400 berth

  Necessary number of berths is roughly estimated as follows:

  Necessary number of berths = designed daily freight volume / unit rate of 1 berth
  = 10,000 (ton/day) / 25(ton/berth)
  = 400 (berth)

  Here, unit rate of 1 berth of 25(tons/berth) is set as the common value in Japan

- Width of Platform : 25 m (the common value in Japan)
- Parking Lot at Berth : Length is 15m, Width is 3m.
- Parking Lot for Collection and Delivery truck : Length is 10m, Width is 3m.
- Roadway Width : 8m one way, 20m in case face to face with berth, 10m in case face to face with area for collection and delivery truck.

(2) Preliminary Design of Truck Terminal

Preliminary design of truck terminal was conducted on the basis of the above conditions. According to the results of preliminary design, a site area of about 101,100m^2 is required.

11.4.3 Parking Facility

(1) Planning Conditions

The proposed parking facility is designed under the following conditions.

- Layout of Parking Lot : Right angle parking , Backward parking
- Parking Lot : Length 5.0m, Width 2.25m.
- Roadway Width : 6.0m
- Parking Capacity : 100 vehicles

(2) Preliminary Design of Parking Facility

Preliminary design of parking facility was conducted on the basis of the above conditions. According to the results of preliminary design, a site area of about 990 m^2 is required.

11.5 Cost Estimation

11.5.1 General

The estimate of the project cost is based on the results of preliminary design, quantity calculation of each work item, and the studies on construction method and operation and maintenance.

The project cost discussed in this chapter consists of the following items.

Investment Cost
- Construction;
- Land Acquisition and Resettlement;
- Engineering Services;
- Supervision Services; and
- Physical Contingency.

The basic premises in estimating the project cost are as follows:

1) All the construction work will be executed by contractor(s) to be employed.

2) The unit cost of each cost component was determined based on the economic conditions prevailing in August 1996 (USD $ 1.0 = Lps.12.10).

3) Engineering services cost is assumed to be 4% of the construction cost and land acquisition and resettlement cost.

4) Supervisory service cost is assumed to be 6% of construction cost.

5) Physical contingency is estimated to be 10% of the total of construction cost, land acquisition and resettlement cost, engineering services cost and supervisory services cost.

The project cost is estimated in financial cost.

11.5.2 Construction Cost

(1) Unit cost for Major Construction Work Items

Table 11.5.1 shows unit cost for major construction work items based on municipal data.

Table 11.5.1 Unit Cost for Major Construction Work Items

Item	Unit	Unit Cost (US$)
1. Earthwork		
Soil Excavation	cu.m	3.30
Embankment	cu.m	4.50
2. Pavement		
Aggregate Subbase Course	cu.m	10.00
Aggregate base Course	cu.m	26.00
Asphalt Concrete Surface (t=10cm)	sq.m	35.00
Overlay (t=5cm)	sq.m	18.00
3. Drainage Structure		
Pipe Culvert (D=1.00m)	l.m	240.00
Box Culvert (1.5mX1.5m)	l.m	400.00
4. Bridges		
PC I-Beam Bridge (L=25m)	sq.m	610.00
PC I=Beam Bridge (L=30m)	sq.m	660.00

(2) Estimated Construction Cost

The summary of estimated construction cost by project is shown in Table 11.5.2.

Table 11.5.2 Summary of Estimated Construction Cost in 1996 Price

Project No.	Construction Cost (1000US$)	Project No.	Construction Cost (1000US$)
Project - 1	23	Project - 13	490
Project - 2	8	Project - 14	1302
Project - 3	183	Project - 15	4221
Project - 4	36	Project - 16	3263
Project - 5	108	Project - 20	115
Project - 6 - 1	1296	Project - 21	164
Project - 6 - 2	4858	Project - 22	164
Project - 7	428	Project - 23	164
Project - 8	2227	Project - 24	164
Project - 9	1972	Project - 25	360
Project - 10	1258	Project - 26	1008
Project - 11 - 1	1969	Project - 27	653
Project - 11 - 2	2222	Project - 28	6430
Project - 12	1624		

See Appendices 11.2 and 11.3 for the breakdowns of estimated construction cost and estimated land acquisition and resettlement cost, respectively.

11.5.3 Land Acquisition and Resettlement Cost

Land acquisition and resettlement cost is estimated based on the area of required land acquisition estimated in the preliminary design and the estimated number of resettled families in the environmental study.

Unit cost of land acquisition and resettlement area decided based on the data researched by the municipality of Tegucigalpa.

11.5.4 Estimated Project Cost

The summary of project cost in 1996 prices is shown in Table 11.5.3.

Table 11.5.3(1) Summary of Project Costs in 1996 Prices

Project - 1

Description	Financial Cost (1000US$)
(1) Construction	23
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	1
(4) Supervision Services	1
(5) Physical Contingency	3
Total	28

Project - 2

Description	Financial Cost (1000US$)
(1) Construction	8
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	0
(4) Supervision Services	0
(5) Physical Contingency	2
Total	10

Project-3

Description	Financial Cost (1000US$)
(1) Construction	183
(2) Land Acquisition and Resettlement	84
(3) Engineering Services	11
(4) Supervision Services	11
(5) Physical Contingency	29
Total	318

Table 11.5.3(2) Summary of Project Costs in 1996 Prices

Project-4

Description	Financial Cost (1000US$)
(1) Construction	36
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	2
(4) Supervision Services	2
(5) Physical Contingency	4
Total	44

Project-5

Description	Financial Cost (1000US$)
(1) Construction	108
(2) Land Acquisition and Resettlement	30
(3) Engineering Services	6
(4) Supervision Services	6
(5) Physical Contingency	15
Total	165

Project-6-1 L=1.390km

Description	Financial Cost (1000US$)
(1) Construction	1296
(2) Land Acquisition and Resettlement	2323
(3) Engineering Services	145
(4) Supervision Services	78
(5) Physical Contingency	384
Total	4226

Table 11.5.3(3) Summary of Project Costs in 1996 Prices

Project-6-2 L=2.230km

Description	Financial Cost (1000US$)
(1) Construction	4858
(2) Land Acquisition and Resettlement	3183
(3) Engineering Services	322
(4) Supervision Services	292
(5) Physical Contingency	865
Total	9520

Project-7 L=0.600km

Description	Financial Cost (1000US$)
(1) Construction	428
(2) Land Acquisition and Resettlement	1874
(3) Engineering Services	92
(4) Supervision Services	26
(5) Physical Contingency	242
Total	2662

Project-8 L=2.520km

Description	Financial Cost (1000US$)
(1) Construction	2227
(2) Land Acquisition and Resettlement	484
(3) Engineering Services	108
(4) Supervision Services	134
(5) Physical Contingency	295
Total	3248

Table 11.5.3(4) Summary of Project Costs in 1996 Prices

Project-9 L=2.100km

Description	Financial Cost (1000US$)
(1) Construction	1972
(2) Land Acquisition and Resettlement	974
(3) Engineering Services	118
(4) Supervision Services	118
(5) Physical Contingency	318
Total	3500

Project-10 L=1.790km

Description	Financial Cost (1000US$)
(1) Construction	1258
(2) Land Acquisition and Resettlement	5790
(3) Engineering Services	282
(4) Supervision Services	75
(5) Physical Contingency	741
Total	8146

Project - 11-1 L=1.000km

Description	Financial Cost (1000US$)
(1) Construction	1969
(2) Land Acquisition and Resettlement	1179
(3) Engineering Services	126
(4) Supervision Services	118
(5) Physical Contingency	339
Total	3731

Table 11.5.3(5) Summary of Project Costs in 1996 Prices

Project - 11-2 L=4.740km

Description	Financial Cost (1000US$)
(1) Construction	2222
(2) Land Acquisition and Resettlement	2323
(3) Engineering Services	182
(4) Supervision Services	133
(5) Physical Contingency	486
Total	5346

Project - 12 (C) L=1.860km

Description	Financial Cost (1000US$)
(1) Construction	1624
(2) Land Acquisition and Resettlement	1993
(3) Engineering Services	145
(4) Supervision Services	97
(5) Physical Contingency	386
Total	4245

Project - 13 (E) L=1.860km

Description	Financial Cost (1000US$)
(1) Construction	490
(2) Land Acquisition and Resettlement	1815
(3) Engineering Services	92
(4) Supervision Services	29
(5) Physical Contingency	243
Total	2669

Table 11.5.3(6) Summary of Project Costs in 1996 Prices

Project-14 L=2.380km

Description	Financial Cost (1000US$)
(1) Construction	1302
(2) Land Acquisition and Resettlement	1376
(3) Engineering Services	107
(4) Supervision Services	79
(5) Physical Contingency	286
Total	3150

Project - 15 (I) L=2.300km

Description	Financial Cost (1000US$)
(1) Construction	4221
(2) Land Acquisition and Resettlement	2209
(3) Engineering Services	257
(4) Supervision Services	254
(5) Physical Contingency	694
Total	7635

Project - 16 (K) L=3.115km

Description	Financial Cost (1000US$)
(1) Construction	3263
(2) Land Acquisition and Resettlement	1132
(3) Engineering Services	176
(4) Supervision Services	195
(5) Physical Contingency	477
Total	5243

Table 11.5.3(7) Summary of Project Costs in 1996 Prices

Project-20

Description	Financial Cost (1000US$)
(1) Construction	115
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	5
(4) Supervision Services	7
(5) Physical Contingency	12
Total	139

Project-21

Description	Financial Cost (1000US$)
(1) Construction	164
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	7
(4) Supervision Services	10
(5) Physical Contingency	17
Total	198

Project-22

Description	Financial Cost (1000US$)
(1) Construction	164
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	7
(4) Supervision Services	10
(5) Physical Contingency	17
Total	198

Table 11.5.3(8) Summary of Project Costs in 1996 Prices

Project-23

Description	Financial Cost (1000US$)
(1) Construction	164
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	7
(4) Supervision Services	10
(5) Physical Contingency	17
Total	198

Project-24

Description	Financial Cost (1000US$)
(1) Construction	164
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	7
(4) Supervision Services	10
(5) Physical Contingency	17
Total	198

Project-25

Description	Financial Cost (1000US$)
(1) Construction	360
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	14
(4) Supervision Services	22
(5) Physical Contingency	40
Total	436

Table 11.5.3(9) Summary of Project Costs in 1996 Prices

Project-26

Description	Financial Cost (1000US$)
(1) Construction	1008
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	40
(4) Supervision Services	60
(5) Physical Contingency	112
Total	1220

Project-27

Description	Financial Cost (1000US$)
(1) Construction	653
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	26
(4) Supervision Services	39
(5) Physical Contingency	72
Total	790

Project-28

Description	Financial Cost (1000US$)
(1) Construction	6430
(2) Land Acquisition and Resettlement	0
(3) Engineering Services	257
(4) Supervision Services	386
(5) Physical Contingency	707
Total	7780

11.6 Construction Plan

11.6.1 Construction Equipment

1) Equipment Intensive Construction

To attain economy in construction and to realize the improvements within a shorter construction period, the equipment intensive construction plan will be adopted. This matter is important, especially since these projects will be carried out in an urban area. .

2) Earthwork Equipment

The use of the following major earthwork equipment is considered in the planning(Table 11.6.1).

Table 11.6.1 Major Earthwork Equipment

Major Works	Equipment	
	New Construction	Improvement
Clearing, Grubbing and Demolition	Bulldozer	Bulldozer Back Hoe
Excavation Loading Hauling	Bulldozer,Tractor Shovel Tractor Shovel Bulldozer, Dump Truck	Bulldozer, Back Hoe Back Hoe Bulldozer, Dump Truck
Spreading Compaction	Bulldozer, Motor Grader Tamping Roller Tire Roller	Bulldozer, Motor Grader Tamping Roller Tire Roller

3) Equipment of Paving Work

The use of the following equipment is considered(Table 11.6.2)

Table 11.6.2 Major Paving Work Equipment

Major Works	Equipment
Subgrade Preparation	Motor Grader, Tire Roller, Macadam Roller
Sub-base	Motor Grader, Tire Roller, Macadam Roller
Prime/Tack Coat	Asphalt Distributor
ATB/Surface Course	Asphalt Finisher,Macadam Roller,Tire Roller

Note: ATB denotes Asphalt Treated Base Course

4) Bridge Construction

The major equipment used for bridge construction is shown in Table 11.6.3

Table 11.6.3 Major Bridge Construction Equipment

Major Works	Equipment
Foundation	Back Hoe, Dump Truck, Truck Crane
Structure Excavation	Back Hoe, Dump Truck, Truck Crane
Substructure	Concrete Pump Truck, Truck Crane
Superstructure	Truck Crane, Erection Girder, Pole Trailer

5) Bridge Construction Method

No major problems are anticipated in the construction of bridge foundations and substructures. PC I-girders will be erected by means of conventional crane erection method or erection girder method.

11.6.2 Construction Time Schedule

1) Conditions for Scheduling

a) Weather Conditions

According to rainfall data, the number of working days for earthwork and the construction of pavement was estimated as shown in Table 11.6.4.

Table 11.6.4 Number of Working Days

Items	Dry Season Nov.- Apr.	Rainy Season May.- Oct.	Annual
Number of rainy days	7.0days/month	18.7days/month	154days
Working efficiency on a rainy day	65%	35%	43.2%
Number of holidays	4.8days/month	4.8days/month	58days
Number of working days	22.8days/month	13.0days/month	215days
Working efficiency	76%	43%	58%

2) Time Schedule

The construction time schedule for each project was prepared based on the conditions described in Subsection 11.6.2 a) Weather Conditions above. Term of compensation is basically 6 months and term of construction is 6 ~ 24 months depending on scale of construction.

3) Implementation Schedule

Construction period of each project is divided into three groups, short, mid and long term. Implementation schedule of each project is shown in Chapter 12.

CHAPTER 12

PROJECT LIST AND IMPLEMENTATION PROGRAM

CHAPTER 12 PROJECT LIST AND IMPLEMENTATION PROGRAM

12.1 Project List

This Master Plan aims to improve the traffic condition in Tegucigalpa by projects to be executed continuously through to the year 2010. For the execution of projects, the whole term of the Master Plan is divided into 3 smaller terms with respective objectives as follows.

Short term (1997-2000) : To strengthen east-west and south-north transportation axes, and to mitigate the traffic congestion in the central area

Mid term (2001-2005) : To strengthen public transportation by the introduction of exclusive bus roads and exclusive bus lanes

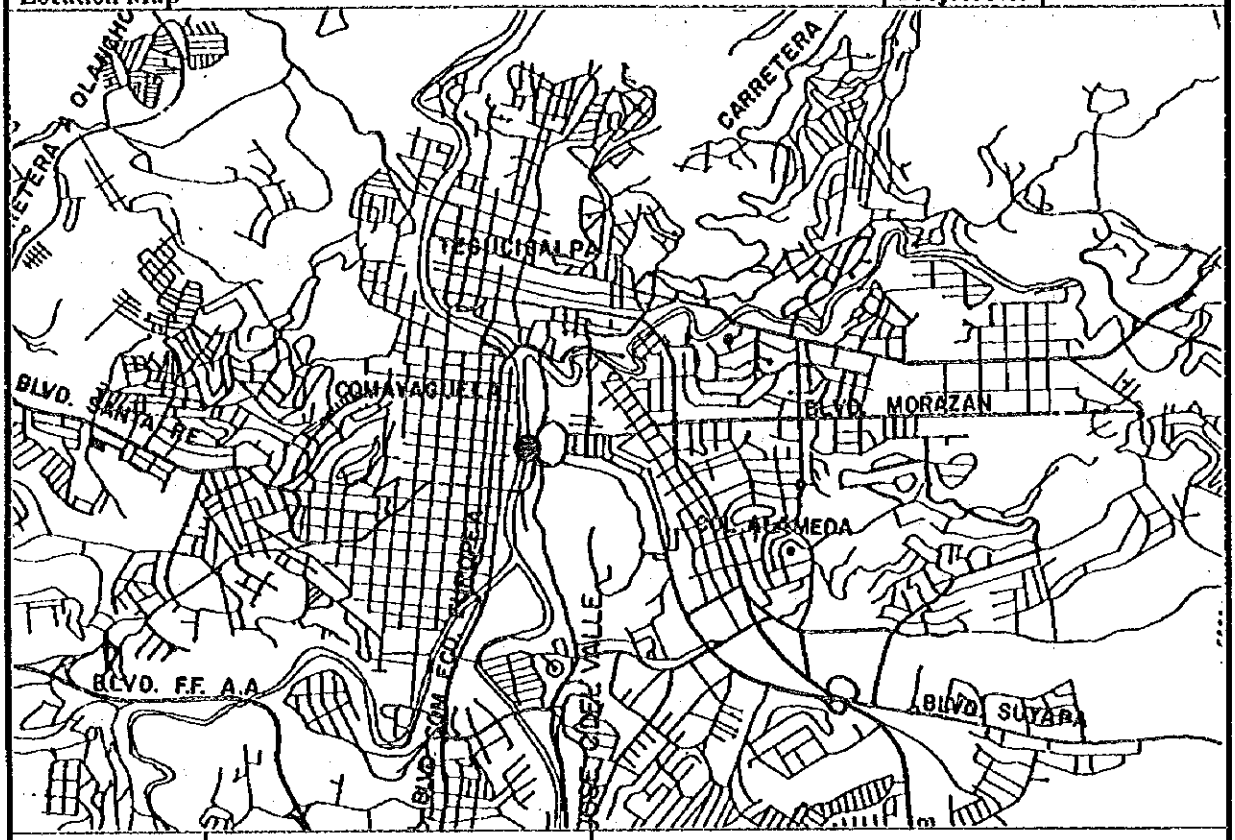
Long term (2006-2010) : To expand the road network in Tegucigalupa by road improvement around the city

The study team selected projects in accordance with the respective objectives taking account of the project scale and the cost and technical matters. For the list of the selected projects, please refer to the Table 10.6.1. Each project is described in detail in the description sheet of Table 12.1.1.

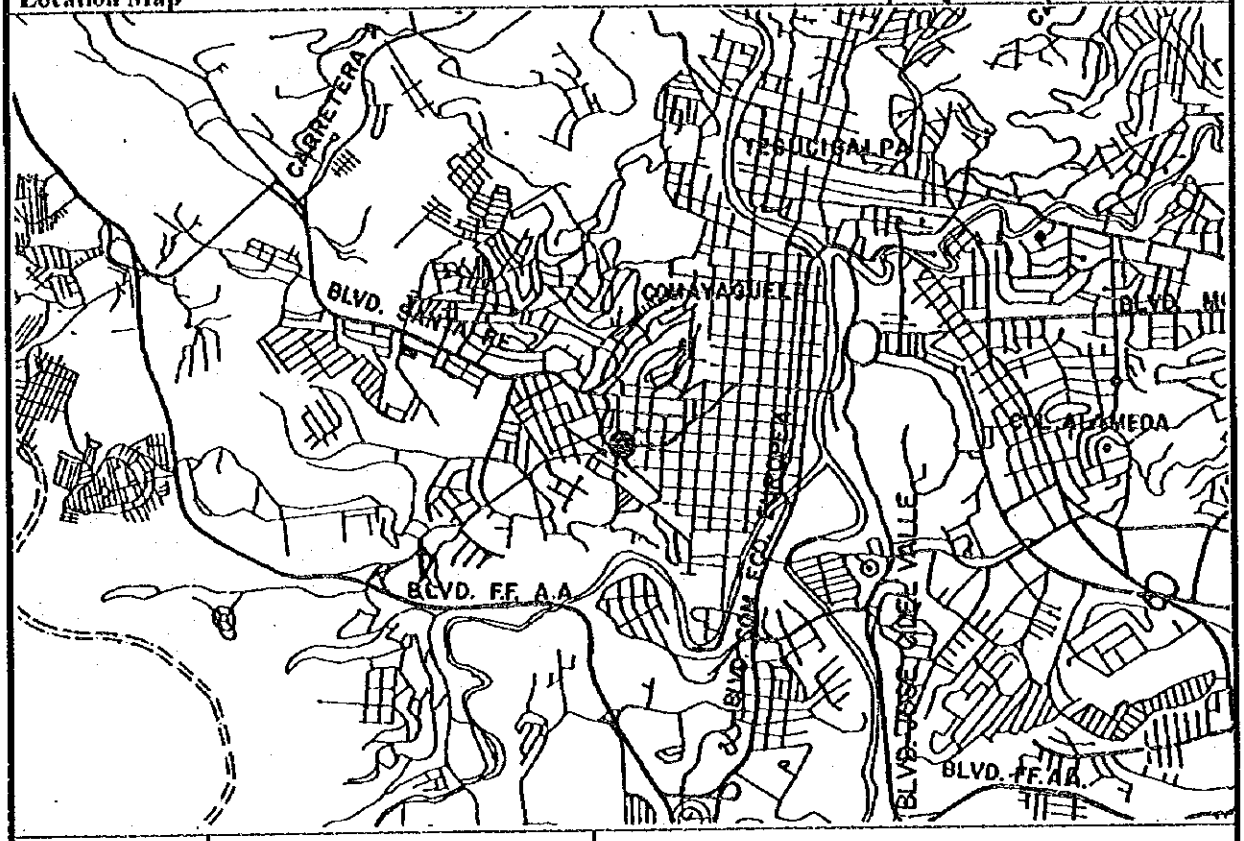
12.2 Implementation Program

Implementation program of selected project is prepared based on the objective of each term and engineering matters as shown in the Table 12.2.1.

Table 12.1.1 Project List

Location Map		Project No.	1
			
Road Length (m)	New Construction	-	
	New Bridge	-	
	Widening	-	
	Overlay	-	
No. of Lanes		-	
Project Cost (1000US$)	Construction	23	
	Land Aquisition,Resettlement	0	
	Others	5	
	Total	28	
Proposed Construction Period		1997 (Urgent)	
Project Description	■ Configuration improvement at intersection of Subida al Estadio Nacional and the circular road of the National Stadium ■ Traffic signal installation ■ Elimination of bottleneck of west-east traffic flow		

Location Map		Project No.	2

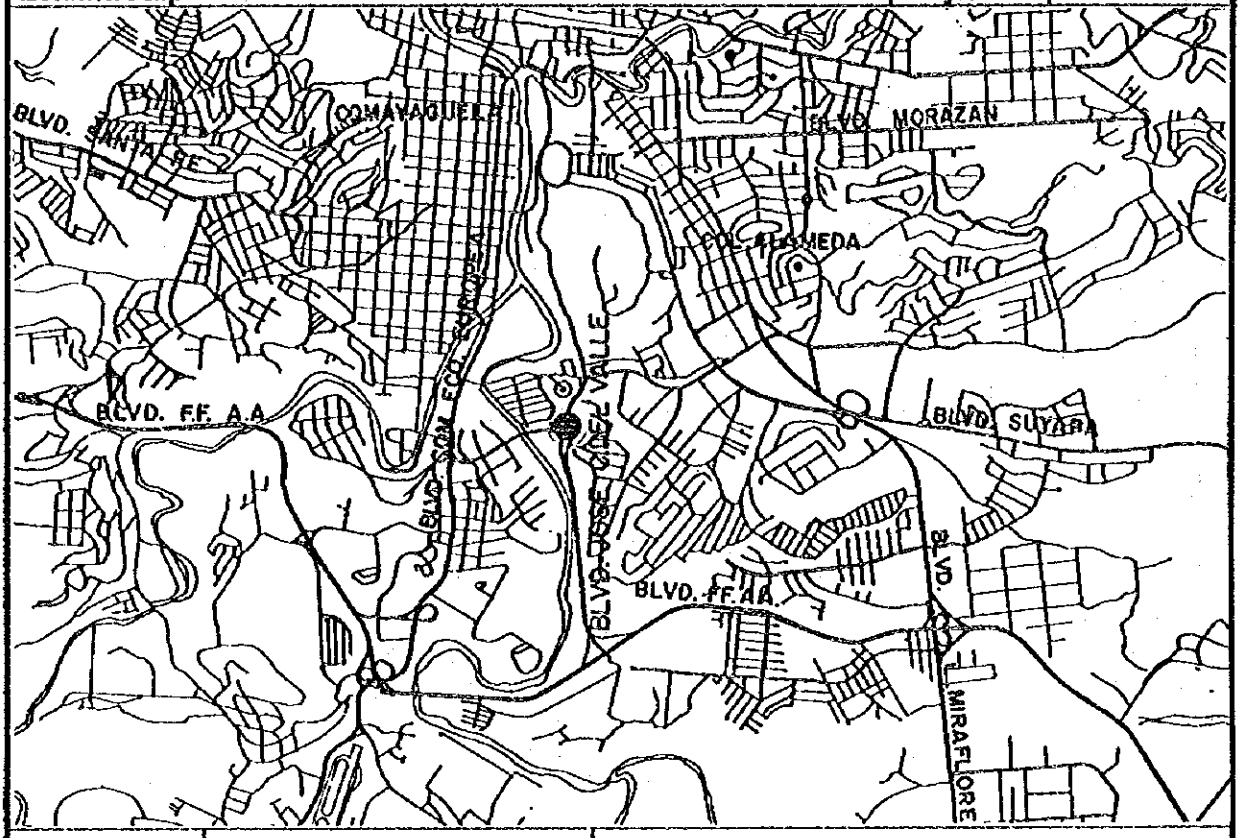


Road Length (m)	New Construction	-
	New Bridge	-
	Widening	-
	Overlay	-
No. of Lanes		-
Project Cost (1000US$)	Construction	8
	Land Aquisition,Resettlement	0
	Others	2
	Total	10
Proposed Construction Period		1997 (Urgent)
Project Description	■ Configuration improvement at intersection of Avenida Cabañas and Boulevard Santa Fé ■ Installation of left-turn lane ■ Securing of smooth traffic flow on Boulevard Santa Fé	

Location Map		Project No.	3

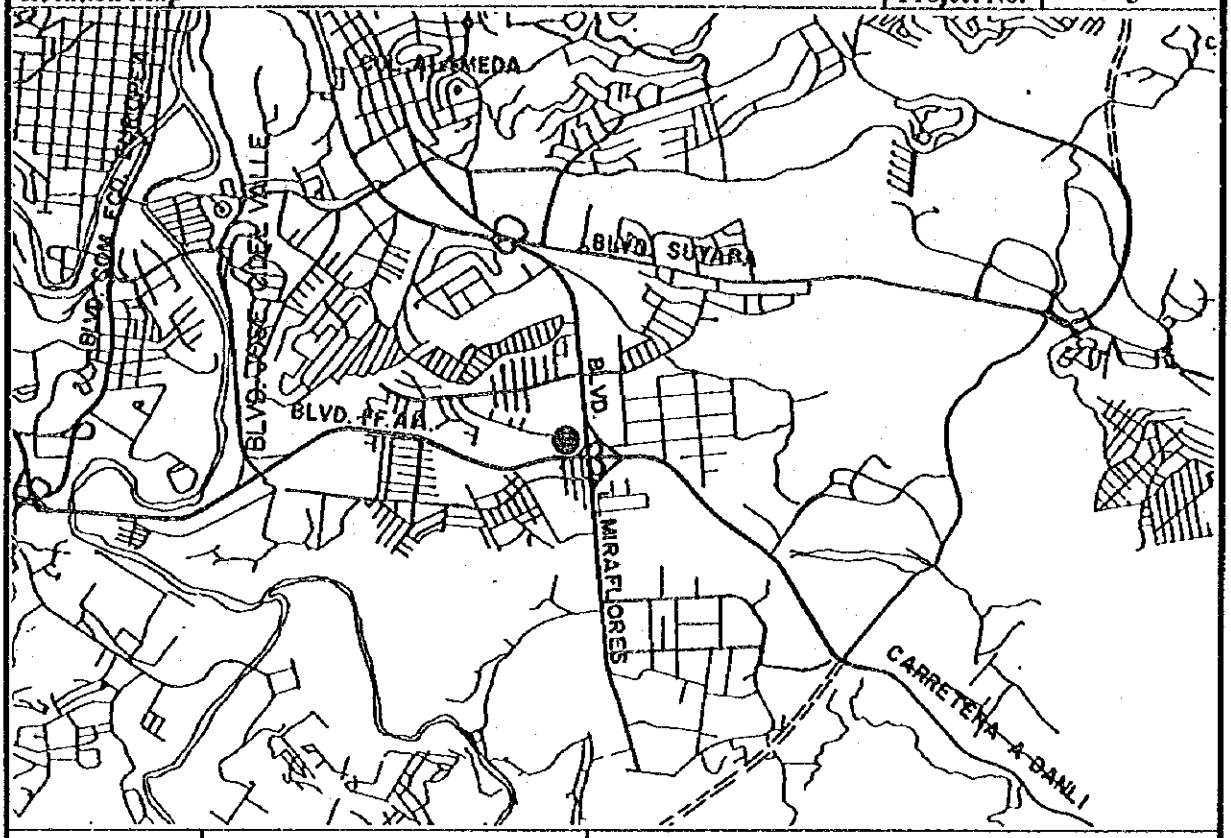
Road Length (m)	New Construction	-
	New Bridge	-
	Widening	-
	Overlay	-
No. of Lanes		-
Project Cost (1000US$)	Construction	183
	Land Aquisition,Resettlement	84
	Others	41
	Total	318
Proposed Construction Period		1997 - 1998 (Urgent)
Project Description	■ Configuration improvement at intersection in front of Institute Hondureno de Seguridad Social on Boulevard Comunidad Europea ■ Change of the Configulation into "+" shape intersection ■ To smooth the traffic flow for the airport on Boulevard Comunidad Europea	

Location Map		Project No.	4



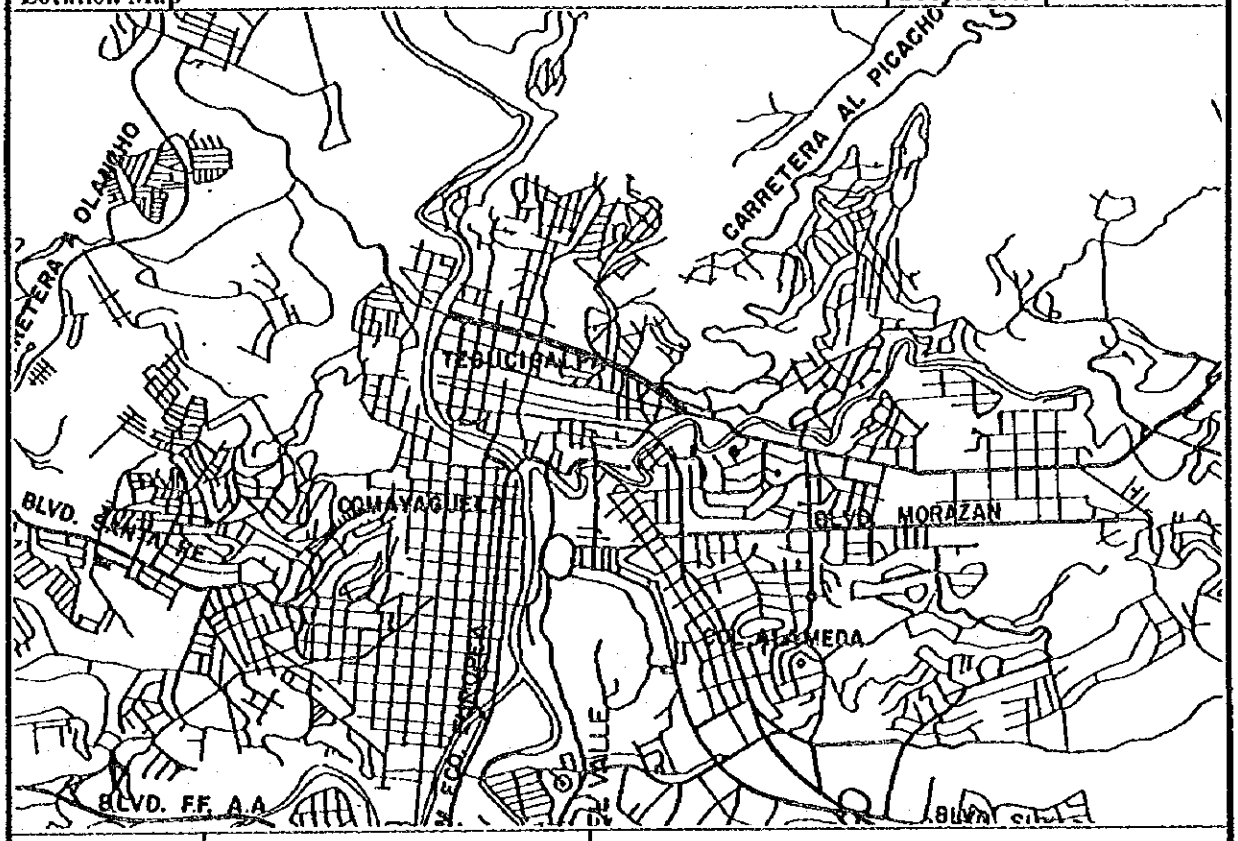
Road Length (m)	New Construction	-
	New Bridge	-
	Widening	-
	Overlay	-
No. of Lanes		-
Project Cost (1000US$)	Construction	36
	Land Aquisition,Resettlement	0
	Others	8
	Total	44
Proposed Construction Period		1997 (Urgent)
Project Description	■ Traffic signal installation at Intersectionof Boulevard José Cecilio del Valle and Calle Golan ■ To mitigate the congestion within the intersection ■ To improve the sight distance	

Location Map	Project No.	5



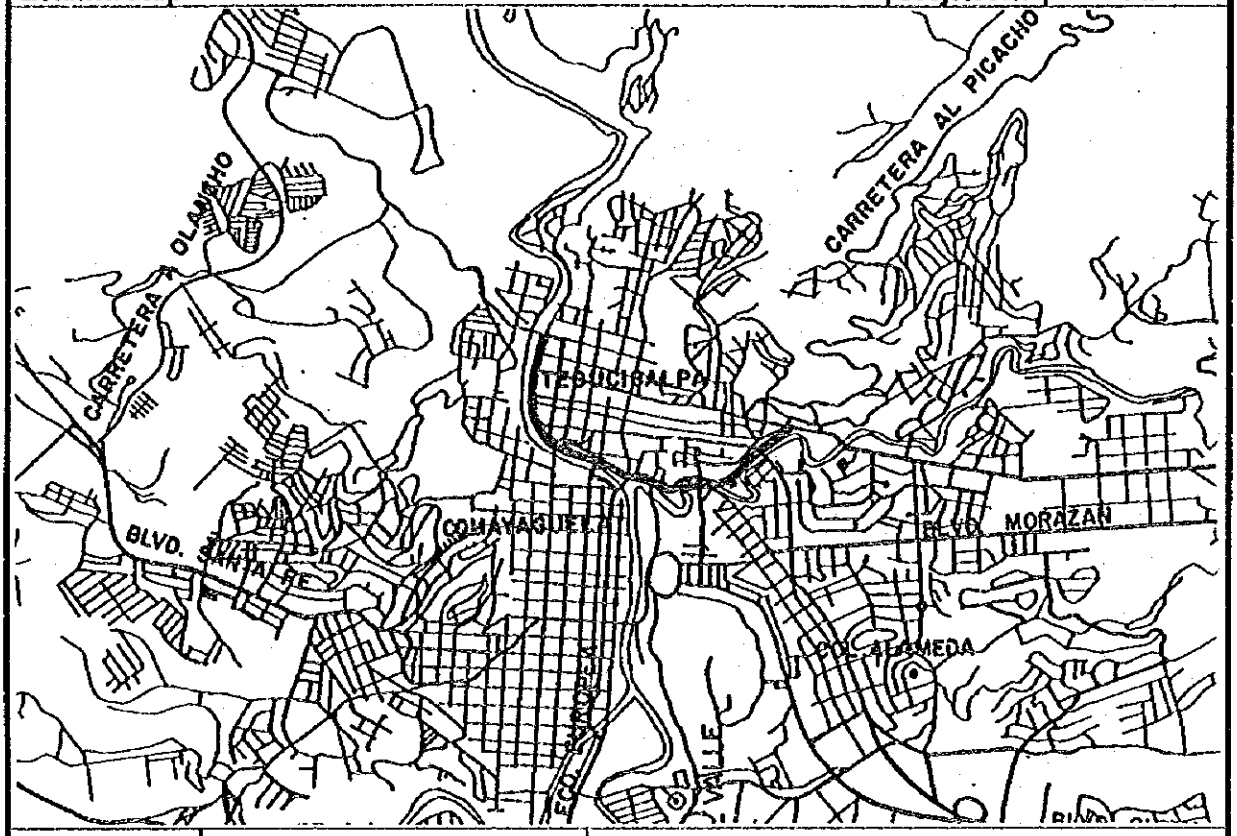
Road Length (m)	New Construction	-
	New Bridge	-
	Widening	-
	Overlay	-
No. of Lanes		-
Project Cost (1000US$)	Construction	108
	Land Aquisition,Resettlement	30
	Others	27
	Total	165
Proposed Construction Period		1997 - 1998 (Urgent)
Project Description	■ Approach Road Construction at grade separation of Boulevard Miraflores and Boulevard Fuerzas Armadaz ■ Exclusion of unnecessary U-turn traffic movement from Boulevard Miraflores	

Location Map	Project No.	6-1



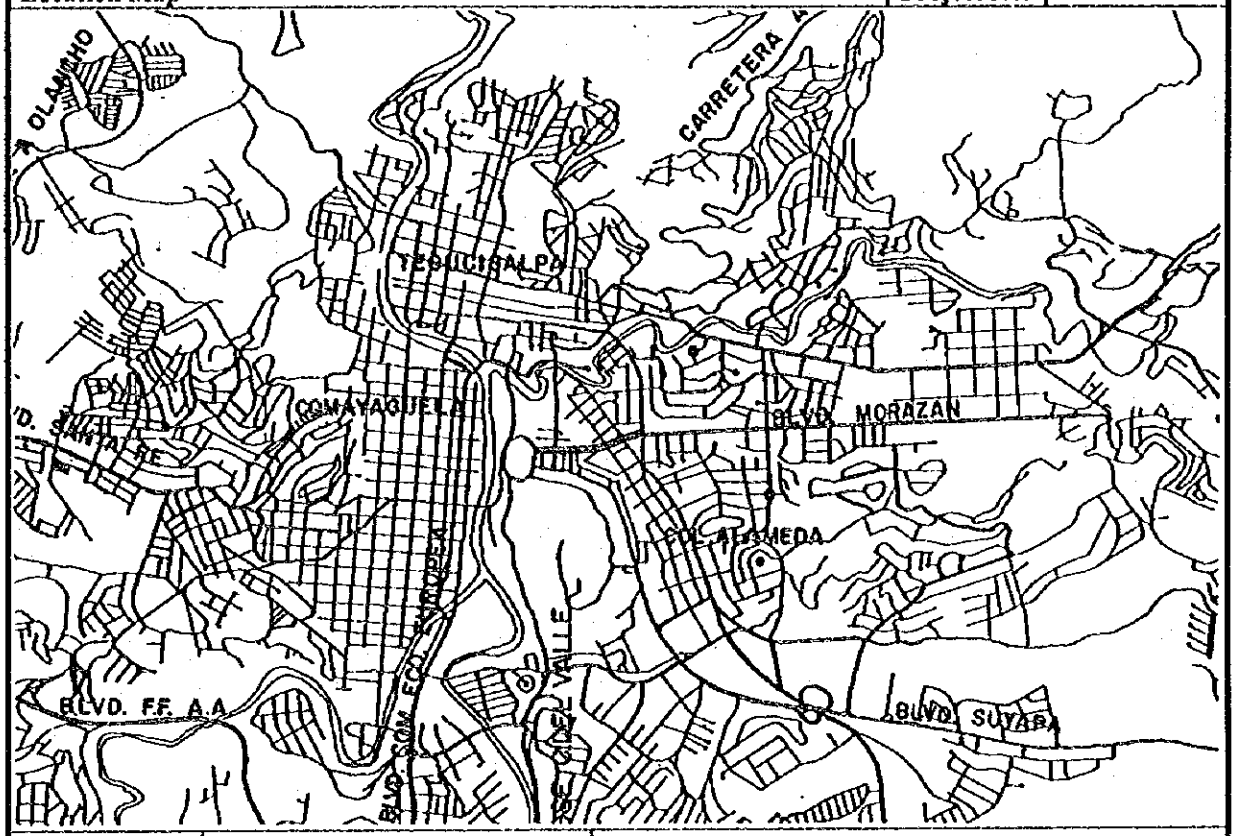
Length (m)	New Construction	690
	New Bridge	100
	Widening	-
	Overlay	-
	Use of Existing Road	600
	Total	1,390
No. of Lanes		2
Project Cost (1000US$)	Construction	1,296
	Land Aquisition,Resettlement	2,323
	Others	607
	Total	4,226
Proposed Construction Period		2006 - 2008 (L)
Project Description	■ Northern part of the inner ring road of Tegucigalupa around the Centro ■ Mitigation of congestion within the central area of Tegucigalpa	

Location Map		Project No.	6-2



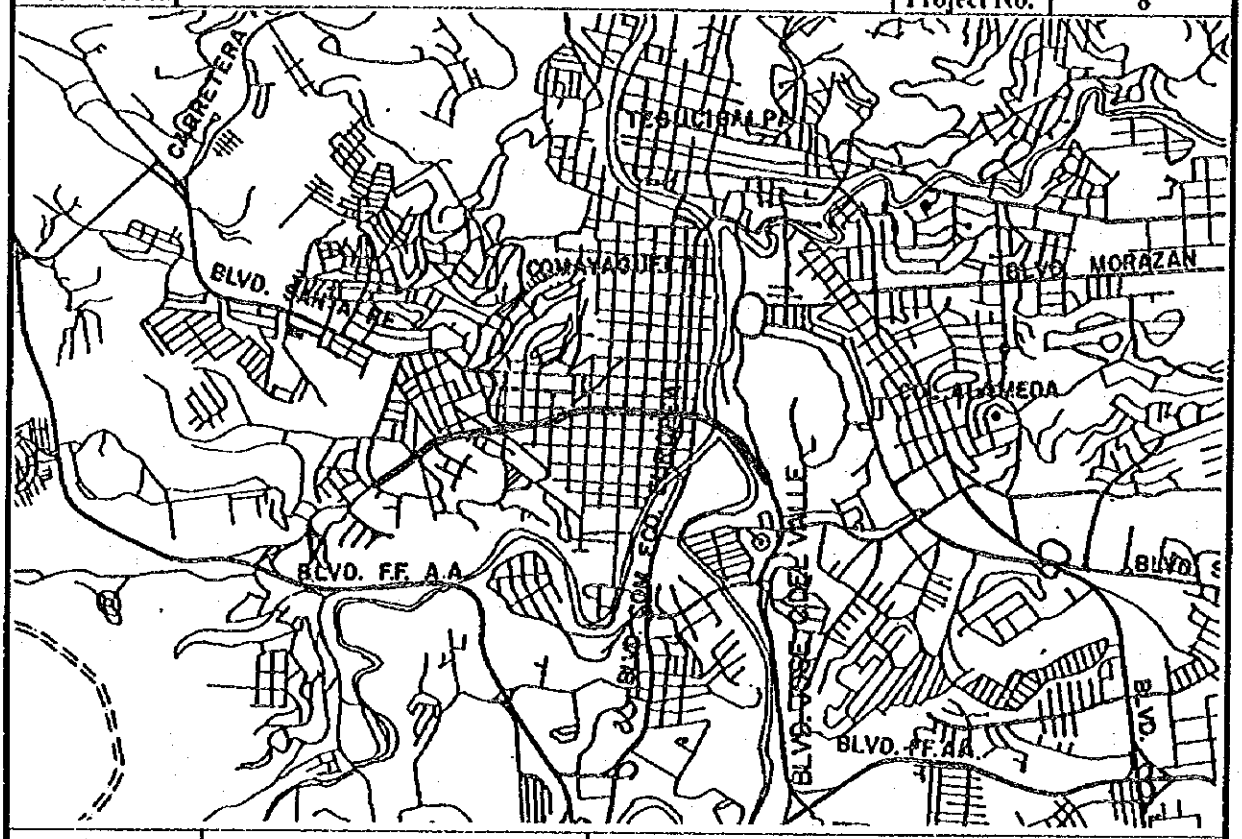
Length (m)	New Construction	745
	New Bridge	410
	Widening	530
	Overlay	1,075 (incl. 530m of widening section)
	Use of Existing Road	-
	Total	2,230
No. of Lanes		2
Project Cost (1000US$)	Construction	4,858
	Land Aquisition,Resettlement	3,183
	Others	1,478
	Total	9,520
Proposed Construction Period		2001 - 2003 (M)
Project Description	■ Southern part of the inner ring road of Tegucigalupa around the Centro ■ Mitigation of congestion within the central area of Tegucigalpa	

Location Map		Project No.	7



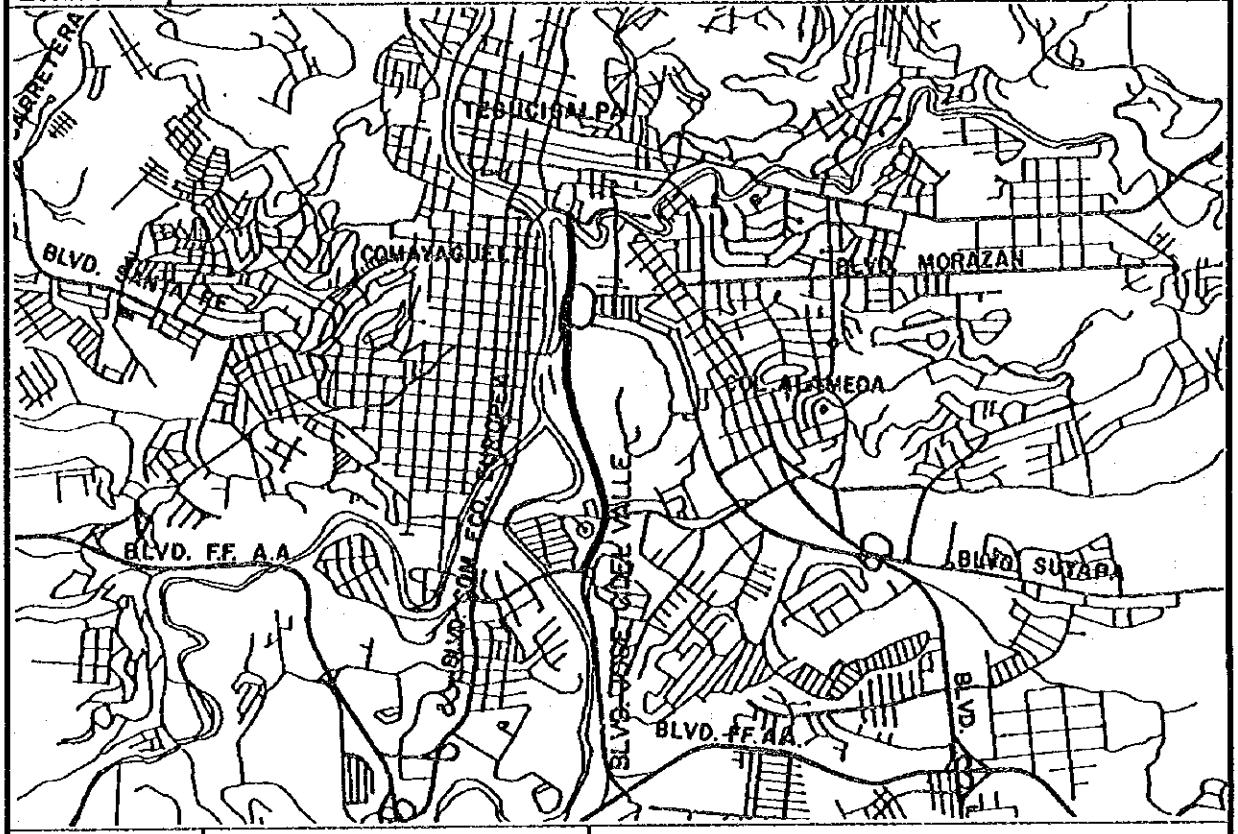
Length (m)	New Construction	-
	New Bridge	-
	Widening	600
	Overlay	600 (incl. 600m of widening section)
	Use of Existing Road	-
	Total	600
No. of Lanes		4
Project Cost (1000US$)	Construction	428
	Land Aquisition,Resettlement	1,874
	Others	360
	Total	2,662
Proposed Construction Period		1997 (S)
Project Description	■ Road widening between Estadio Nacional and Boulevard Morazán ■ To strengthen the east-west axis	

Location Map		Project No.	8



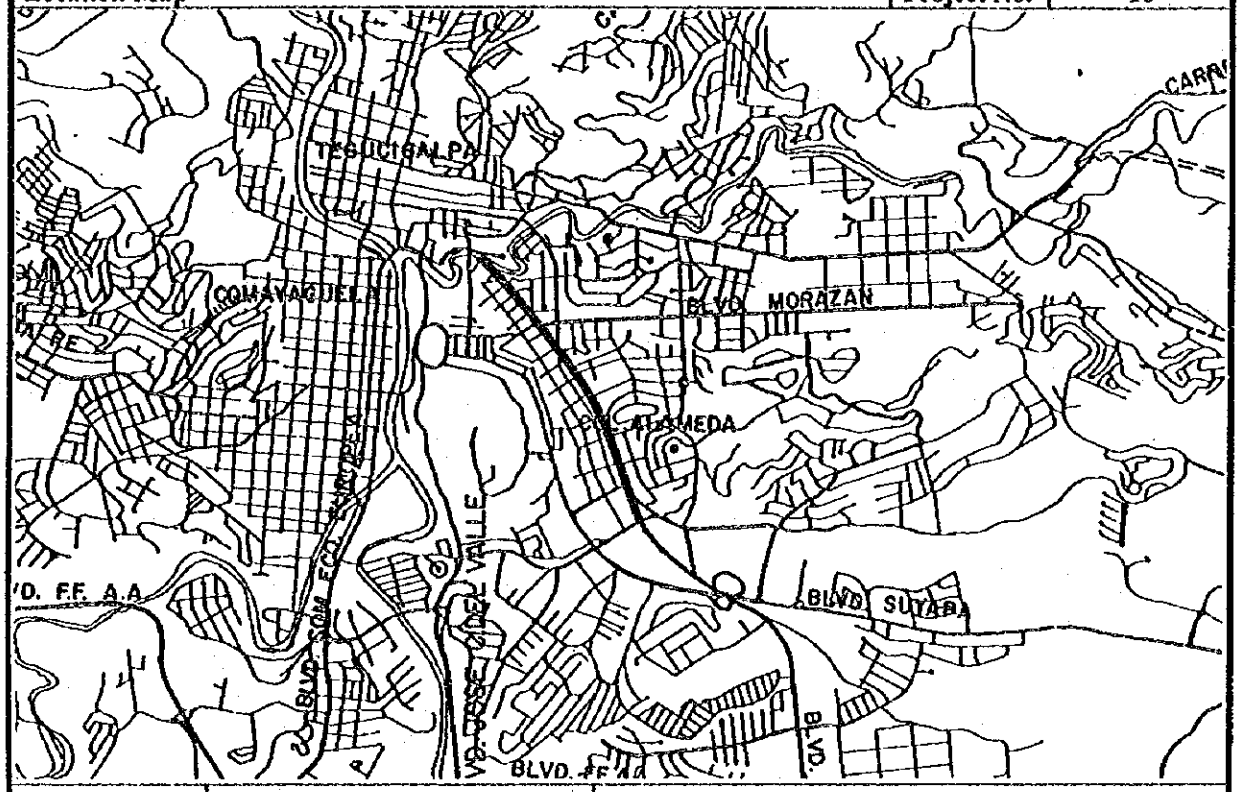
Length (m)	New Construction	515
	New Bridge	125
	Widening	-
	Overlay	-
	Use of Existing Road	1,880
	Total	2,520
No. of Lanes		2
Project Cost (1000US$)	Construction	2,227
	Land Aquisition,Resettlement	484
	Others	537
	Total	3,248
Proposed Construction Period		1997 - 1999 (S)
Project Description	■ Construction of new bridge in the south of Puente de Juan Ramon Malino up to Boulevard José Cecilio de Valle ■ Overlay from the new bridge to Calle Nickson	

Location Map		Project No.	9



Length (m)	New Construction	300
	New Bridge	100
	Widening	1,700
	Overlay	1,700 (incl. 1,700m of widening section)
	Use of Existing Road	-
	Total	2,100
No. of Lanes		4
Project Cost (1000US$)	Construction	1,972
	Land Aquisition,Resettlement	974
	Others	554
	Total	3,500
Proposed Construction Period		1998 - 2000 (S)
Project Description	■ Road widening from 2 lanes to 4 lanes between Calle Isla and José Cecilio del Valle ■ To accommodate the traffic coming from the west of Tegucigalupa through the new bridge ■ To mitigate the congestion on Boulevard Comunidad Europea	

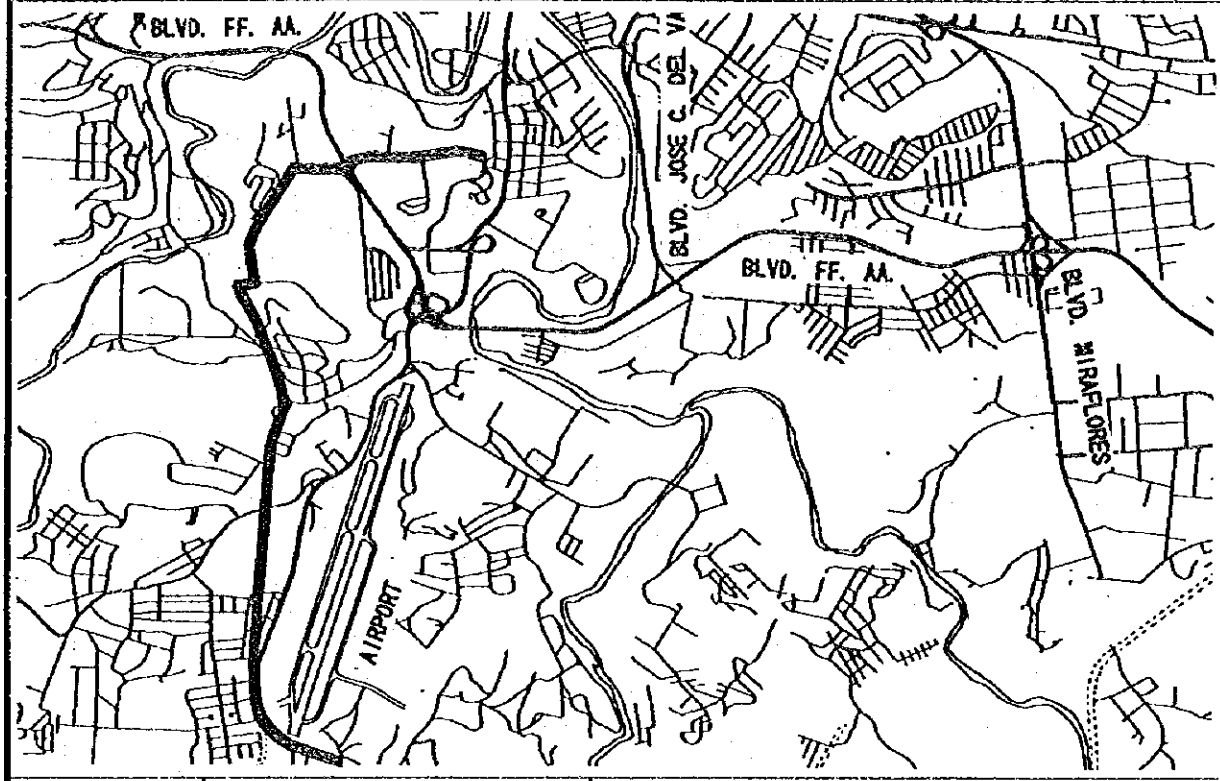
Location Map		Project No.	10



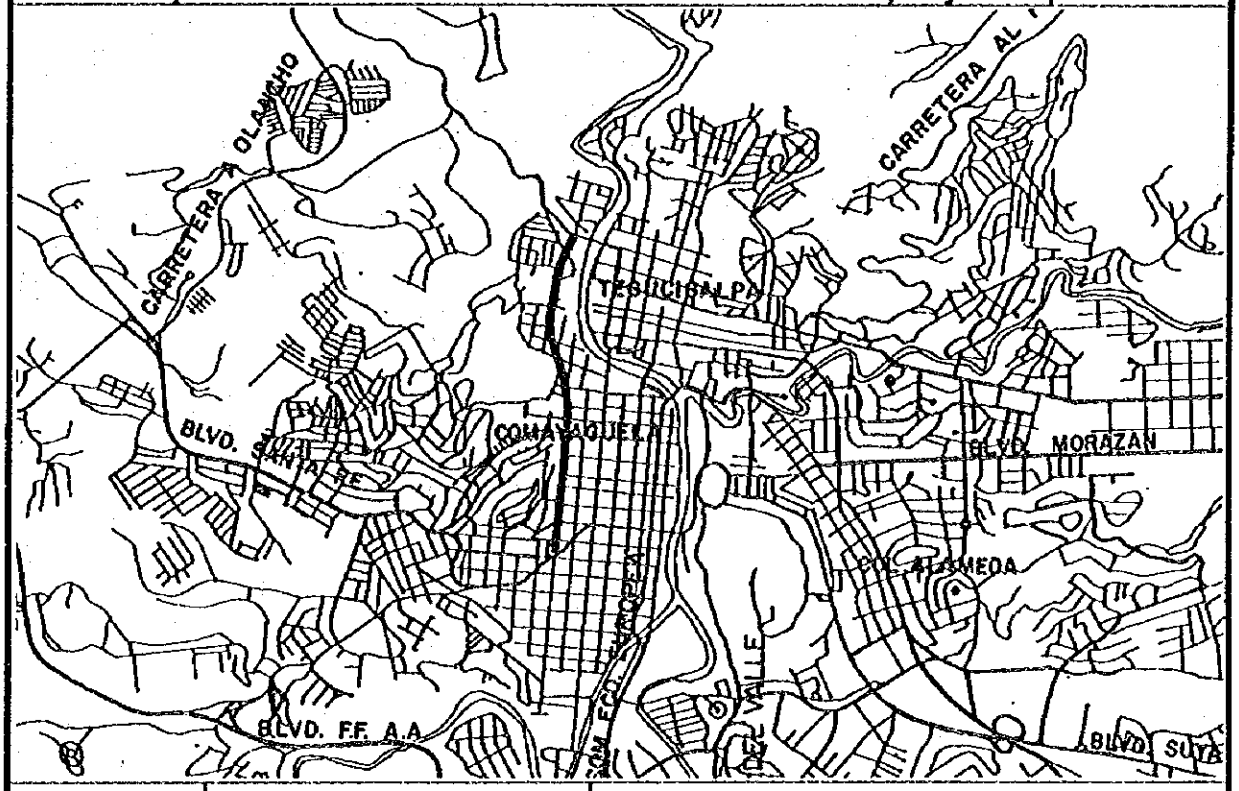
Length (m)	New Construction	-
	New Bridge	-
	Widening	1,790
	Overlay	1,790 (incl. 1,790m of widening section)
	Use of Existing Road	-
	Total	1,790
No. of Lanes		4
Project Cost (1000US$)	Construction	1,258
	Land Aquisition,Resettlement	5,790
	Others	1,098
	Total	8,146
Proposed Construction Period		2007 - 2009 (L)
Project Description	■ Road widening of Boulvard Juan Manuel Galves ■ To accommodate the traffic from Miraflores and Colonia Kennedy	

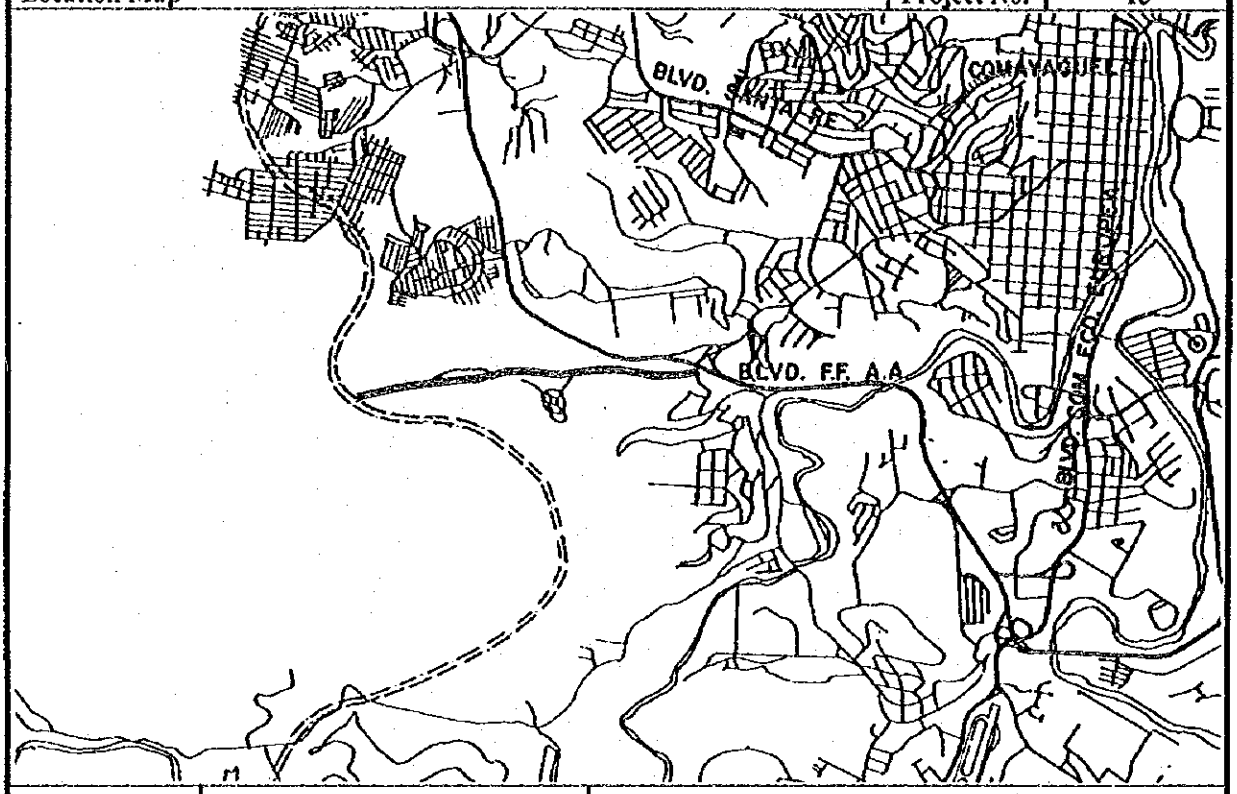
Location Map		Project No.	11-1
			
Length (m)	New Construction	880	
	New Bridge	120	
	Widening	-	
	Overlay	-	
	Use of Existing Road	-	
	Total	1,000	
No. of Lanes		2	
Project Cost (1000US$)	Construction	1,969	
	Land Aquisition,Resettlement	1,179	
	Others	583	
	Total	3,731	
Proposed Construction Period		1998 - 2000(S)	
Project Description	■ Bridge construction and construction of new road in the part of expansion of Avenida 6 ■ Mitigation of traffic congestion on Boulevard Comunidad Europea		

Location Map		Project No.	11-2

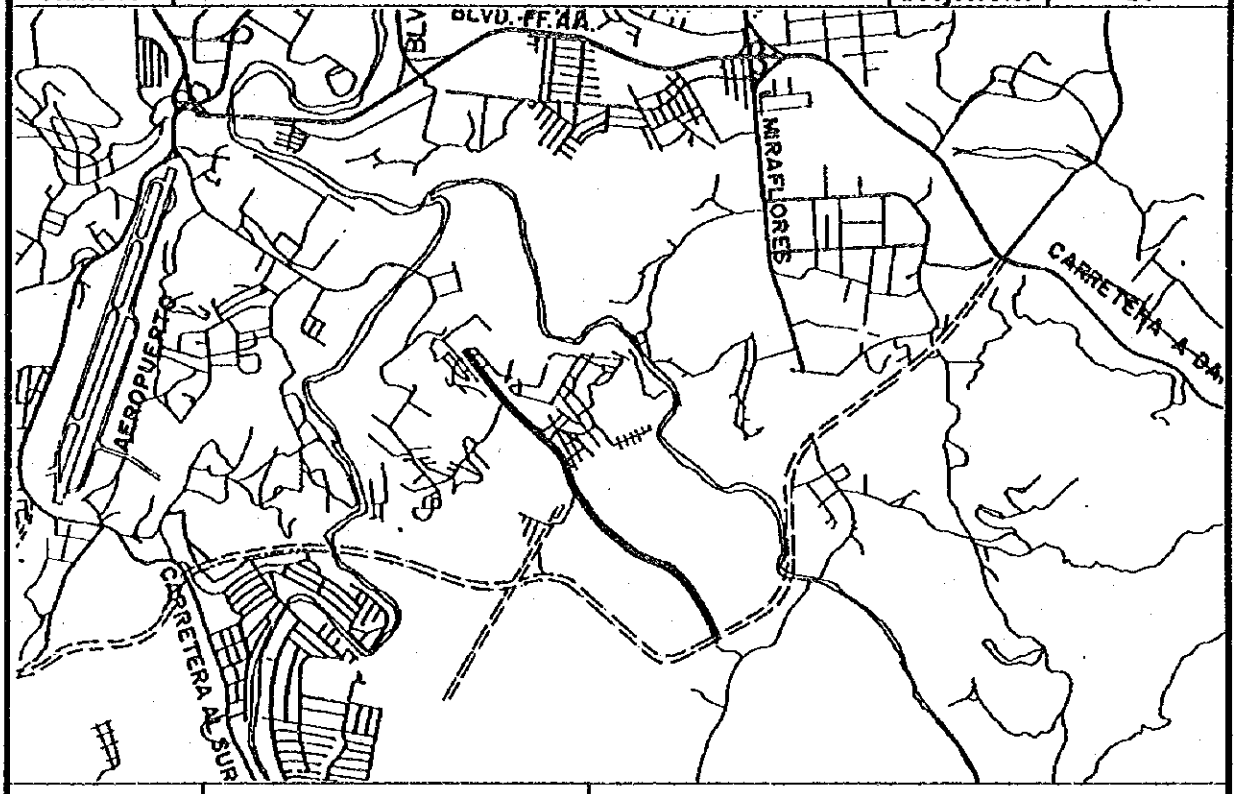


Length (m)	New Construction	1,880
	New Bridge	60
	Widening	1,970
	Overlay	1,970 (incl. 1,970m of widening section)
	Use of Existing Road	830
	Total	4,740
No. of Lanes		2
Project Cost (1000US$)	Construction	2,222
	Land Aquisition,Resettlement	2,323
	Others	801
	Total	5,346
Proposed Construction Period		2002 - 2004 (M)
Project Description	■ Road widening and construction of new road from new bridge to Toncontin as a Bypass of Boulevard Comunidad Europea ■ To mitigate the traffic congestion on Boulevard Comunidad Europea	

Location Map		Project No.	12
			
Length (m)	New Construction	1,360	
	New Bridge	-	
	Widening	500	
	Overlay	500 (incl. 500 m of widening section)	
	Use of Existing Road	-	
	Total	1,860	
No. of Lanes		2	
Project Cost (1000US$)	Construction	1,624	
	Land Aquisition,Resettlement	1,993	
	Others	628	
	Total	4,245	
Proposed Construction Period		2003 - 2005 (M)	
Project Description	■ Road construction and widening of Avenidad 8 ■ Accommodation of traffic overflow resulting from the introduction of exclusive bus road and exclusive bus lanes		

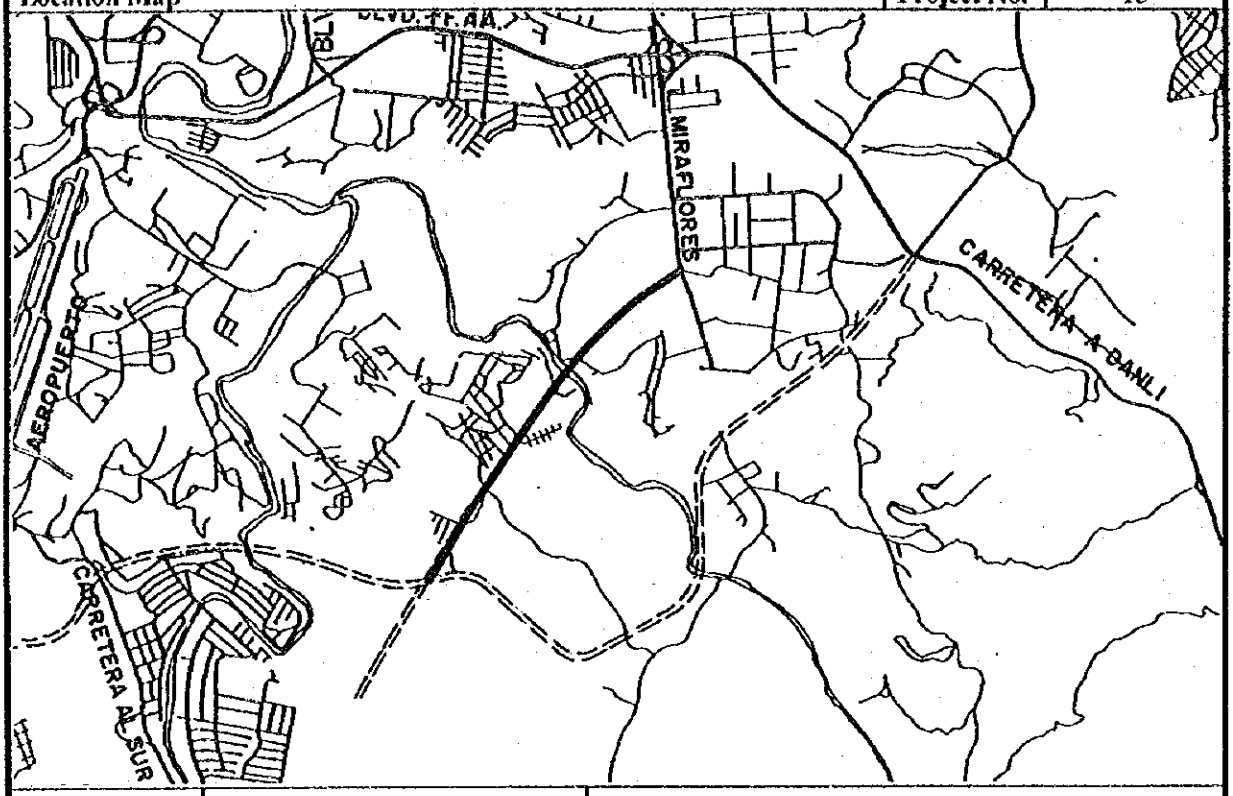
Location Map		Project No.	13
			
Length (m)	New Construction	-	
	New Bridge	-	
	Widening	-	
	Overlay	1,400	
	Use of Existing Road	460	
	Total	1,860	
No. of Lanes		2	
Project Cost (1000US$)	Construction	490	
	Land Aquisition,Resettlement	1,815	
	Others	364	
	Total	2,669	
Proposed Construction Period		2007 - 2008 (L)	
Project Description	■ Road improvement of the section between Anillo Periférico and Boulvard Fuerzas Armadas ■ Accommodation of traffic from western part of the study area outside the Anillo Periférico		

Location Map		Project No.	14

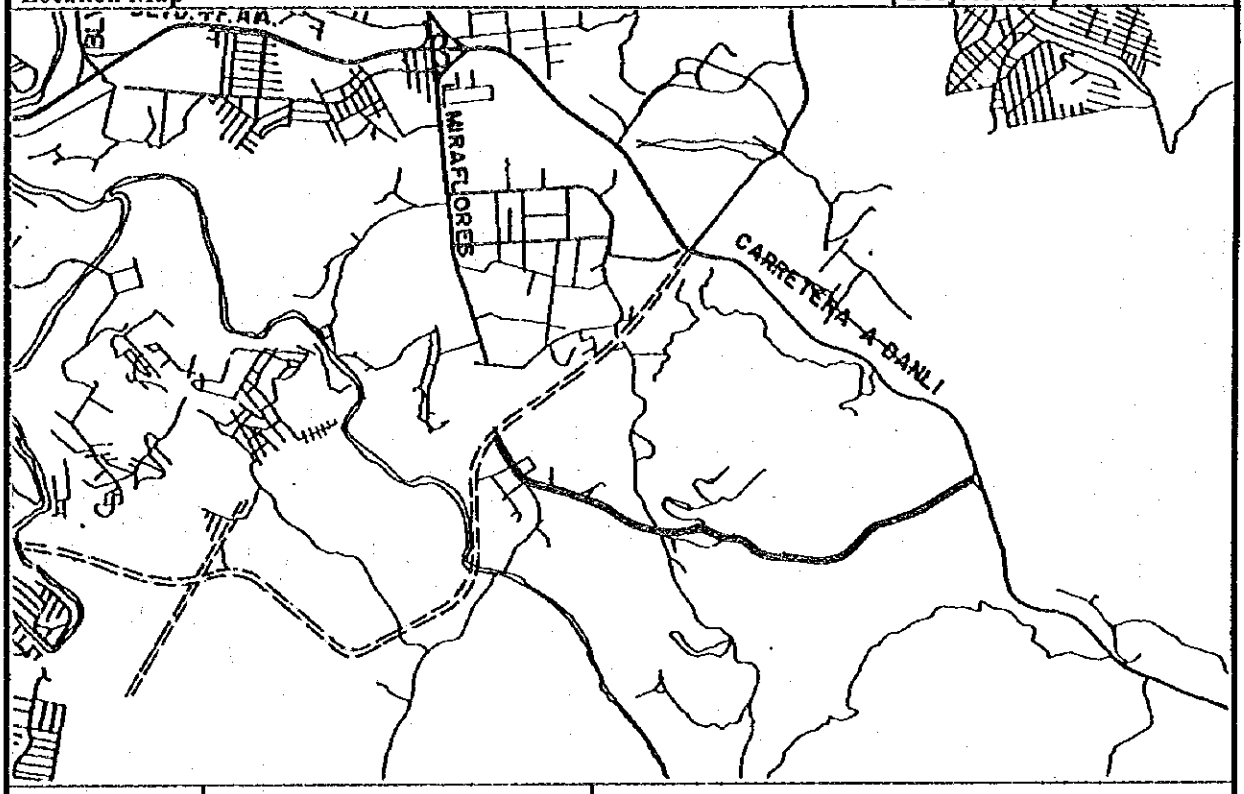


Length (m)	New Construction	1,230
	New Bridge	-
	Widening	1,150
	Overlay	1,150 (incl. 1,150m of widening section)
	Use of Existing Road	-
	Total	2,380
No. of Lanes		2
Project Cost (1000US$)	Construction	1,302
	Land Aquisition,Resettlement	1,376
	Others	471
	Total	3,150
Proposed Construction Period		2008 - 2009 (L)
Project Description	■ Construction and widening of road between Colonia San José de la Vega and Anillo Periférico ■ Promotion of the development the southern part of the study area outside Anillo Periferico. ■ Connection of the southern part outside the Anillo Periférico with the Centro	

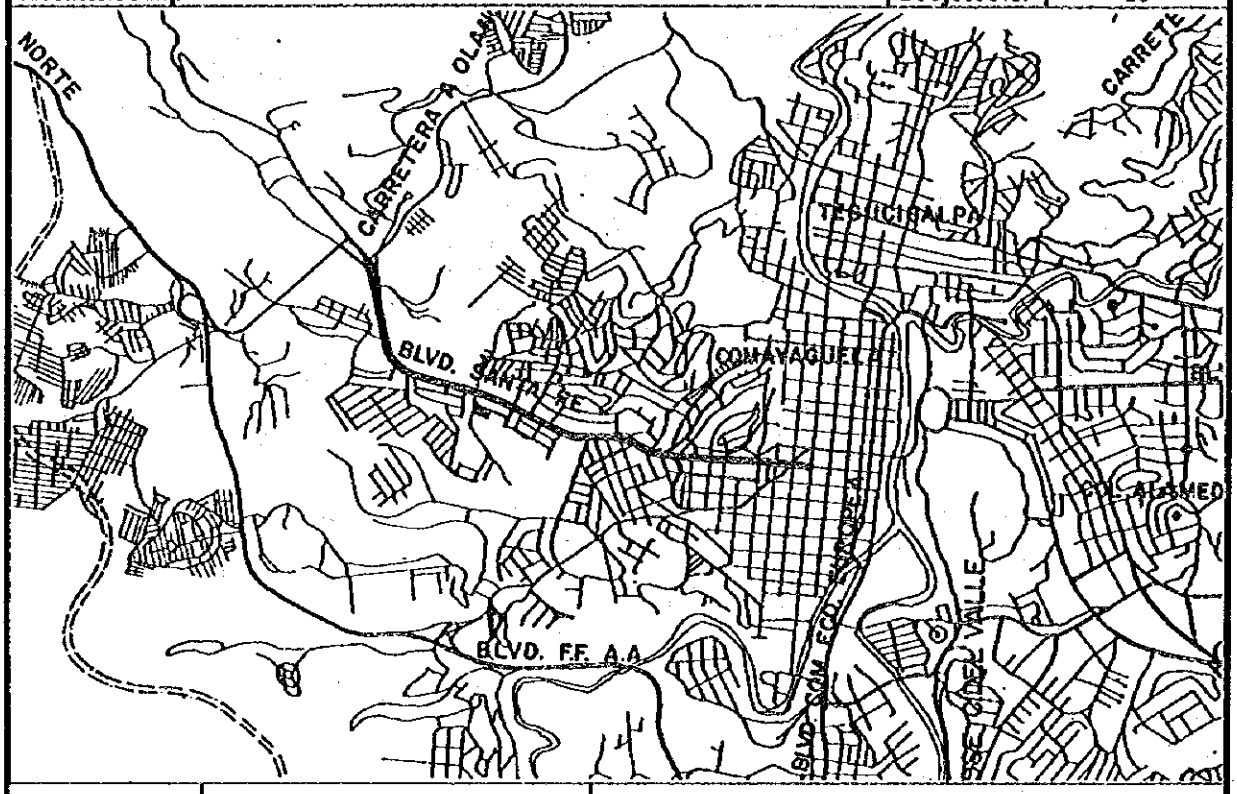
Location Map		Project No.	15



Length (m)	New Construction	1,510
	New Bridge	265
	Widening	-
	Overlay	-
	Use of Existing Road	-
	Total	2,300
No. of Lanes		2
Project Cost (1000US$)	Construction	4,221
	Land Aquisition,Resettlement	2,209
	Others	1,204
	Total	7,635
Proposed Construction Period		2009 - 2010 (L)
Project Description	■ Construction and widening of road between Colonia Kennedy and Anillo Periférico ■ To connect the southern part outside the Anillo Periférico with Boulvard Miraflores	

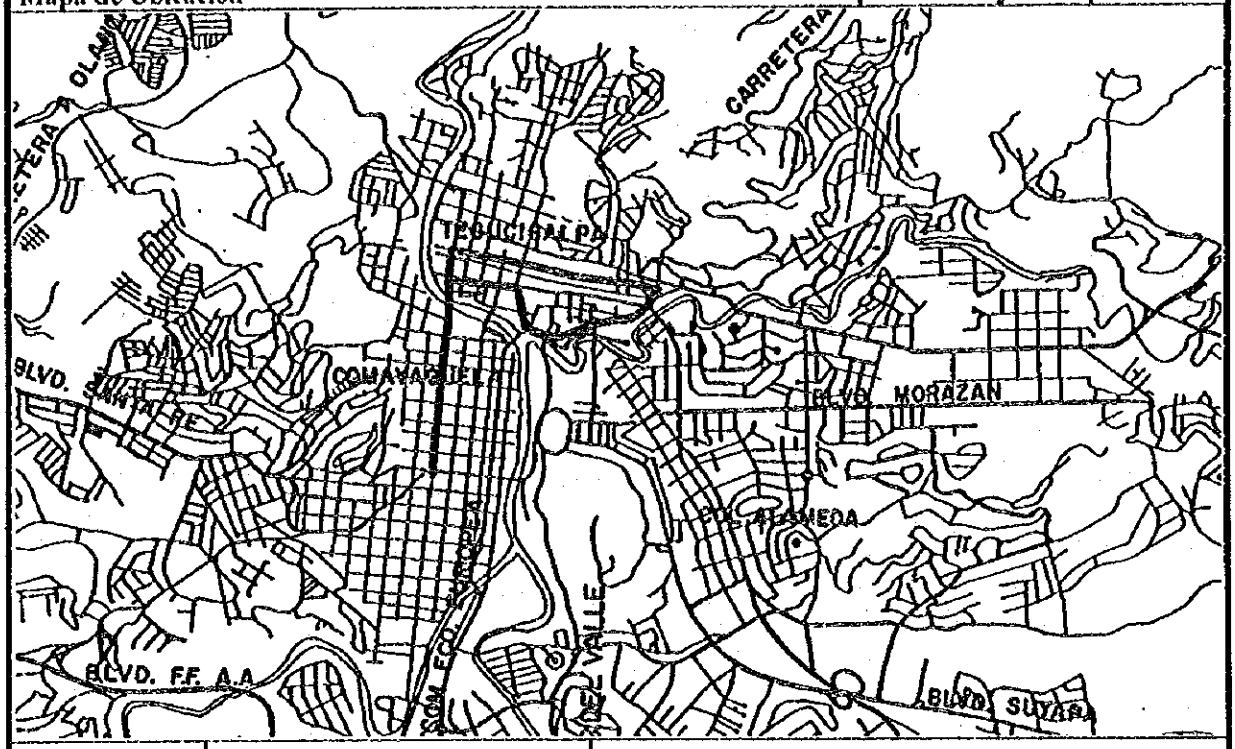
Location Map		Project No.	16
			
Length (m)	New Construction	1,925	
	New Bridge	75	
	Widening	1,115	
	Overlay	1,115 (incl. 1,150m of widening section)	
	Use of Existing Road	-	
	Total	3,115	
No. of Lanes		2	
Project Cost (1000US$)	Construction	3,263	
	Land Aquisition,Resettlement	1,132	
	Others	849	
	Total	5,243	
Proposed Construction Period		2009 - 2010 (L)	
Project Description	■ Construction and widening of road between Anillo Periférico and Carretera a Oriente ■ To mitigate the congestion on Boulvard Fuerzas Armadas ■ To function as a bypass of the road connecting to Boulvard Fuerzas Armadas from Danli		

Location Map		Project No.	18



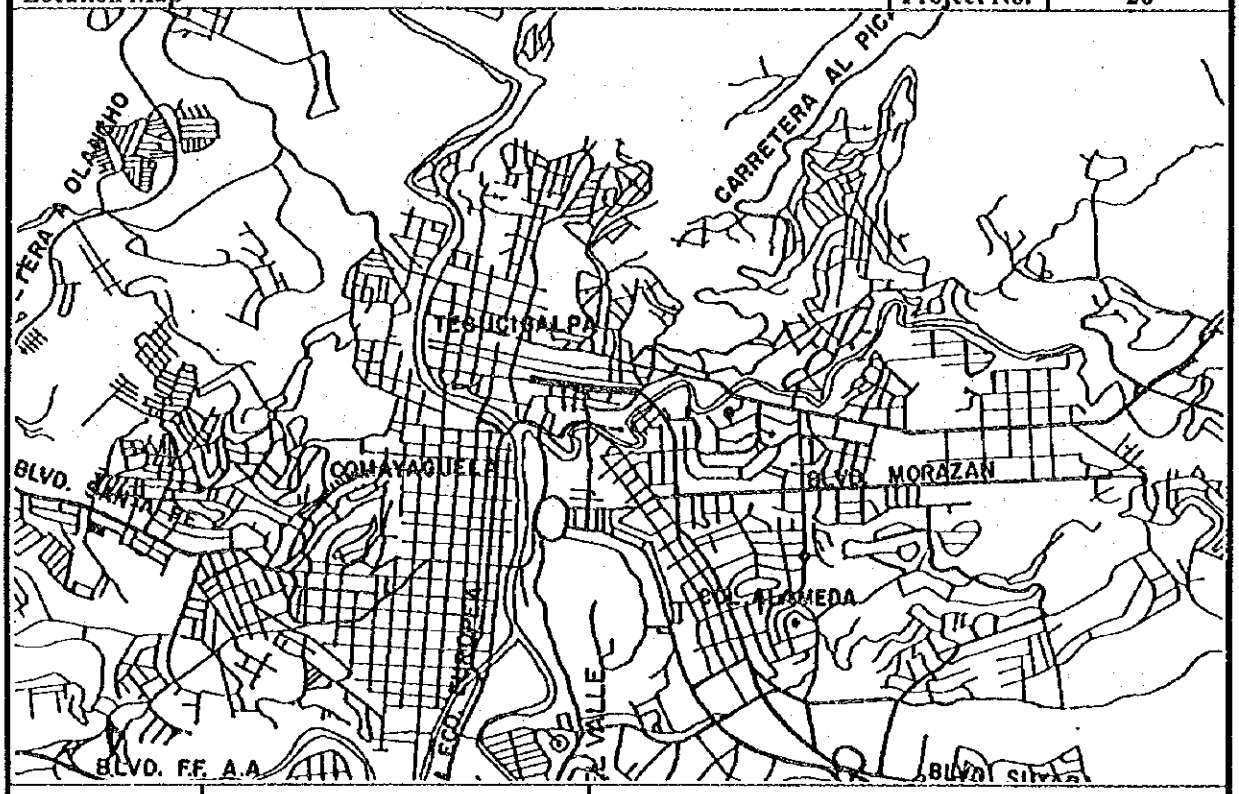
Length (m)	New Construction	–
	New Bridge	–
	Widening	–
	Overlay	–
	Use of Existing Road	–
	Total	–
No. of Lanes		–
Project Cost (1000US$)	Construction	–
	Land Aquisition,Resettlement	–
	Others	–
	Total	–
Proposed Construction Period		2001 (M)
Project Description	■ To make the public transportation efficient by introduction of the exclusive bus lanes from Salida a Olancho to Avenida 6 in the center of Comayagüela	

Mapa de Ubicación		No del Proyecto	19



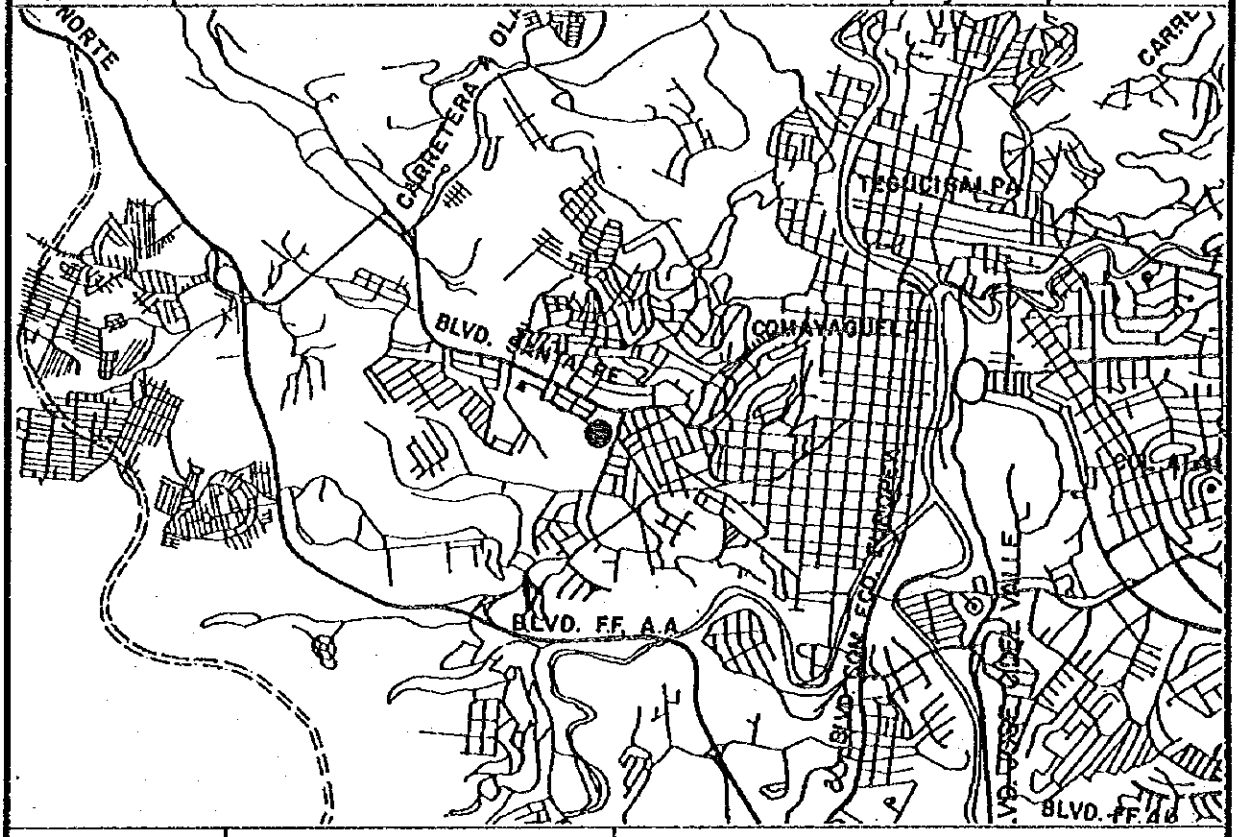
Longitud (m)	Nueva Construcción	-
	Nuevo Puente	-
	Ampliación	-
	Capa Superpuesta	-
	Uso de la Carretera Existente	-
	Total	-
Número de Carriles		-
Costo del Proyecto (US$1000)	Construcción	-
	Adquisición de Tierras, Establecimiento	-
	Otros	-
	Total	-
Período de Construcción Propuesto		2001(M)
Descripción del Proyecto	■ Hacer eficiente el transporte público mediante la introducción de vías exclusivas de buses en las siguientes calles: ☐ Avenida 6 desde la Calle 9 en el centro de Comayagüela hacia el Puente Carias. ☐ Avenida Miguel de Cervantes desde la Calle La Concordia hacia la Calle Salvador Mendiente. ☐ Avenida Máximo Jérez desde la Calle La Concordia hacia el Cine Presidente.		

Location Map		Project No.	20



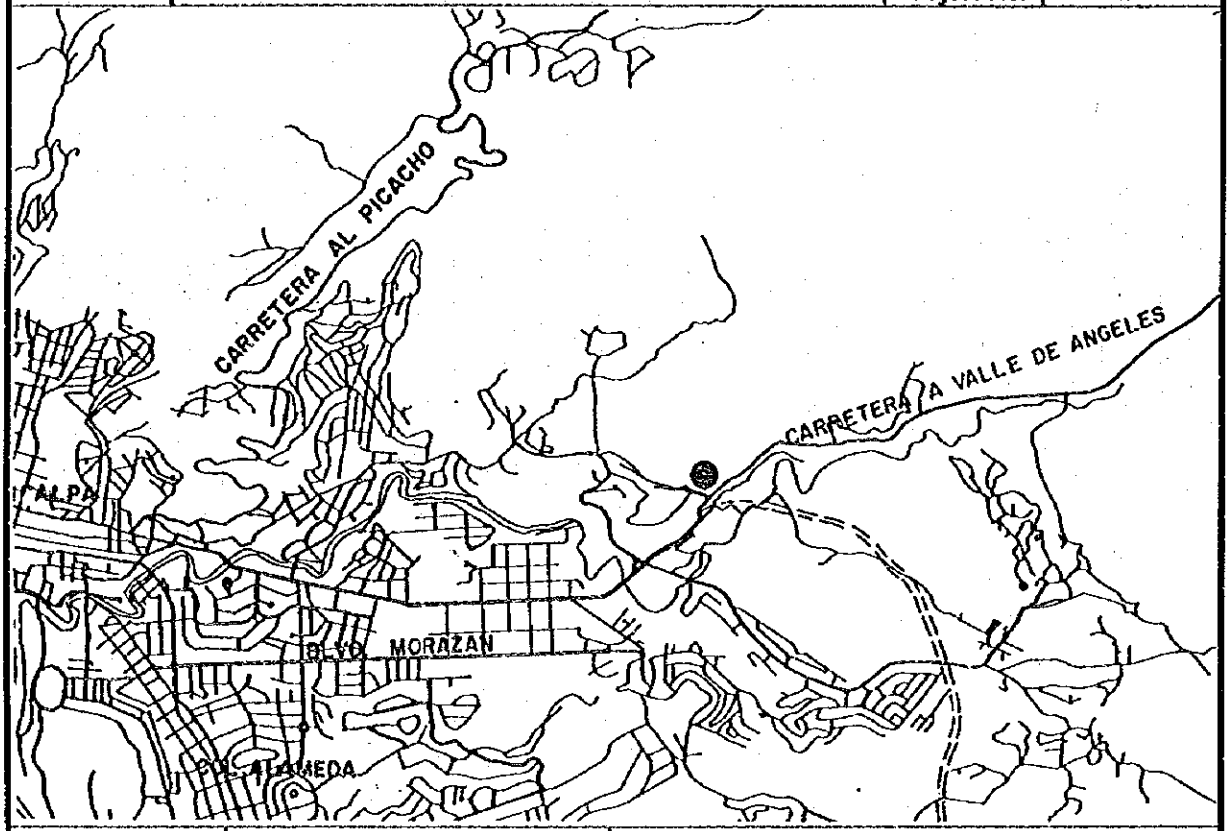
Length (m)	New Construction	530
	New Bridge	-
	Widening	-
	Overlay	-
	Use of Existing Road	-
	Total	530
No. of Lanes		-
Project Cost (1000US$)	Construction	115
	Land Aquisition,Resettlement	0
	Others	24
	Total	139
Proposed Construction Period		2001(M)
Project Description	■ To preserve the central area of Tegucigalpa for tourists and as a relaxation area for citizens, community road is introduced on Avenida Miguel de Cervantes from Puente San Rafael to Plaza Francisco Morazan.	

Location Map		Project No.	21



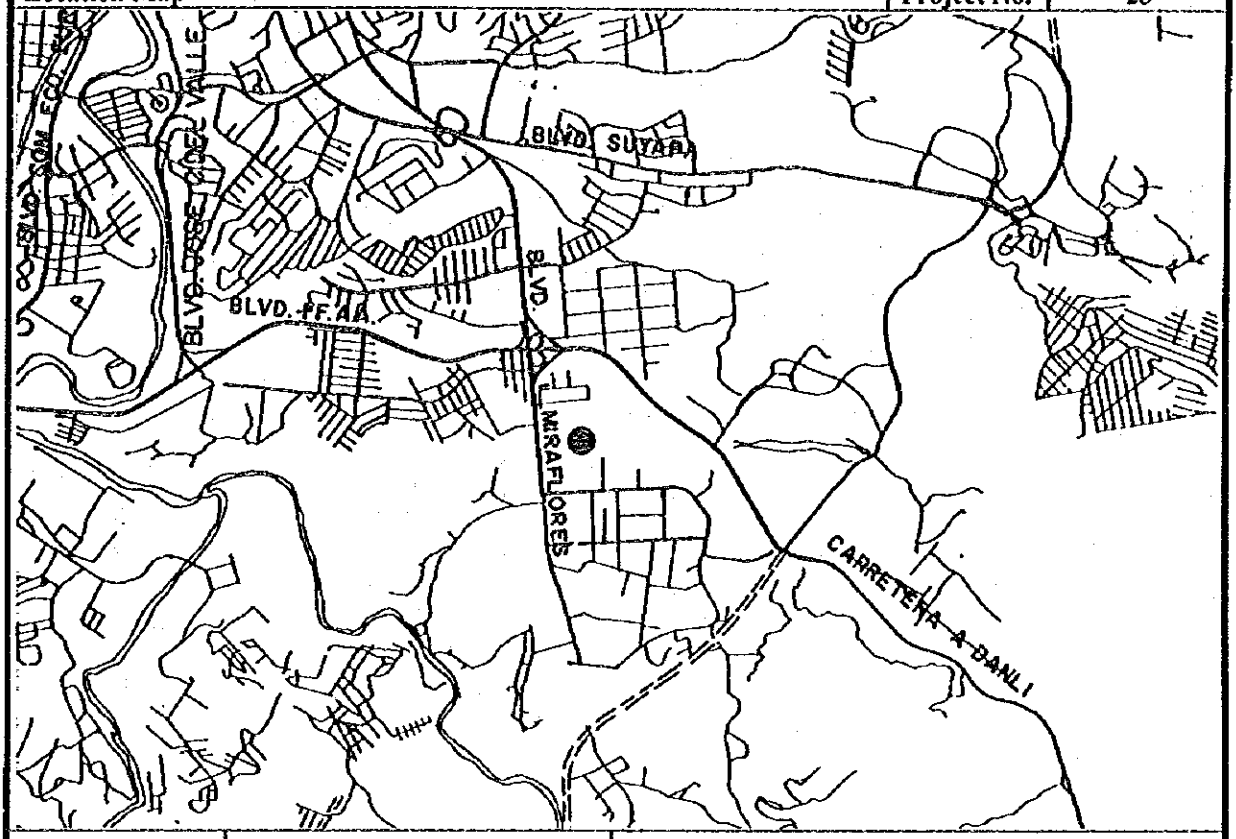
Characteristics	Name of Terminal	Santa Fé
	Function	Interurban - Urban
	D/A Passengers Demand	6,900 persons
	Facility Requirement (m^2)	4,020 m^2
No. of Lanes		–
Project Cost (1000US$)	Construction	164
	Land Aquisition,Resettlement	0
	Others	34
	Total	198
Proposed Construction Period		2001 (M)
Project Description	■ To connect northbound interurban buses for (San Pedro Sula, Comayagüela, Olancho, etc.) with urban buses.	

Location Map		Project No.	22



Characteristics	Name of Terminal	21 de Octubre
	Function	Interurban - Urban
	D/A Passengers Demand	2,500 persons
	Facility Requirement (m^2)	4,020 m^2
No. of Lanes		--
Project Cost (1000US$)	Construction	164
	Land Aquisition,Resettlement	0
	Others	34
	Total	198
Proposed Construction Period		2001 (M)
Project Description	■ To connect east-bound interurban buses for the (Ville de Angeles, San Juancito, etc.)	

Location Map		Project No.	23



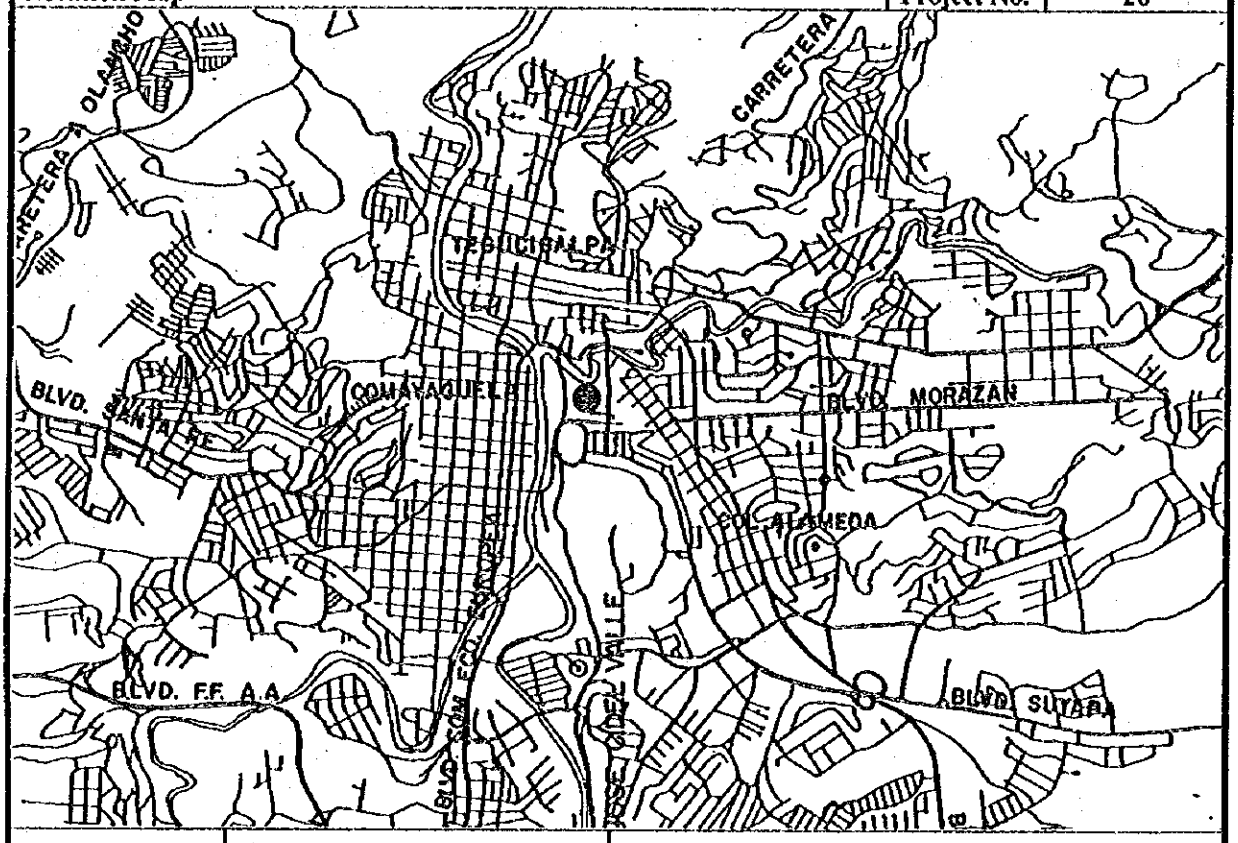
Characteristics	Name of Terminal	Miraflores
	Function	Interurban - Urban
	D/A Passengers Demand	2,200 persons
	Facility Requirement (m^2)	4,020 m^2
No. of Lanes		–
Project Cost (1000US$)	Construction	164
	Land Aquisition,Resettlement	0
	Others	34
	Total	198
Proposed Construction Period		2001 (M)
Project Description	■ To connect southeast-bound interurban buses for the (El Zamorano, Danli, etc.) with urban buses	

Location Map		Project No.	24
			
Characteristics	Name of Terminal	Aeropuerto	
	Function	Interurban - Urban	
	D/A Passengers Demand	10,100 persons	
	Facility Requirement (m^2)	4,020 m^2	
No. of Lanes		–	
Project Cost (1000US$)	Construction	164	
	Land Aquisition,Resettlement	0	
	Others	34	
	Total	198	
Proposed Construction Period		2001 (M)	
Project Description	■ To connect south-bound interurban buses for the (Choluteca, Punta Raton, Nicaragua, El Salvador) with urban buses		

Location Map		Project No.	25

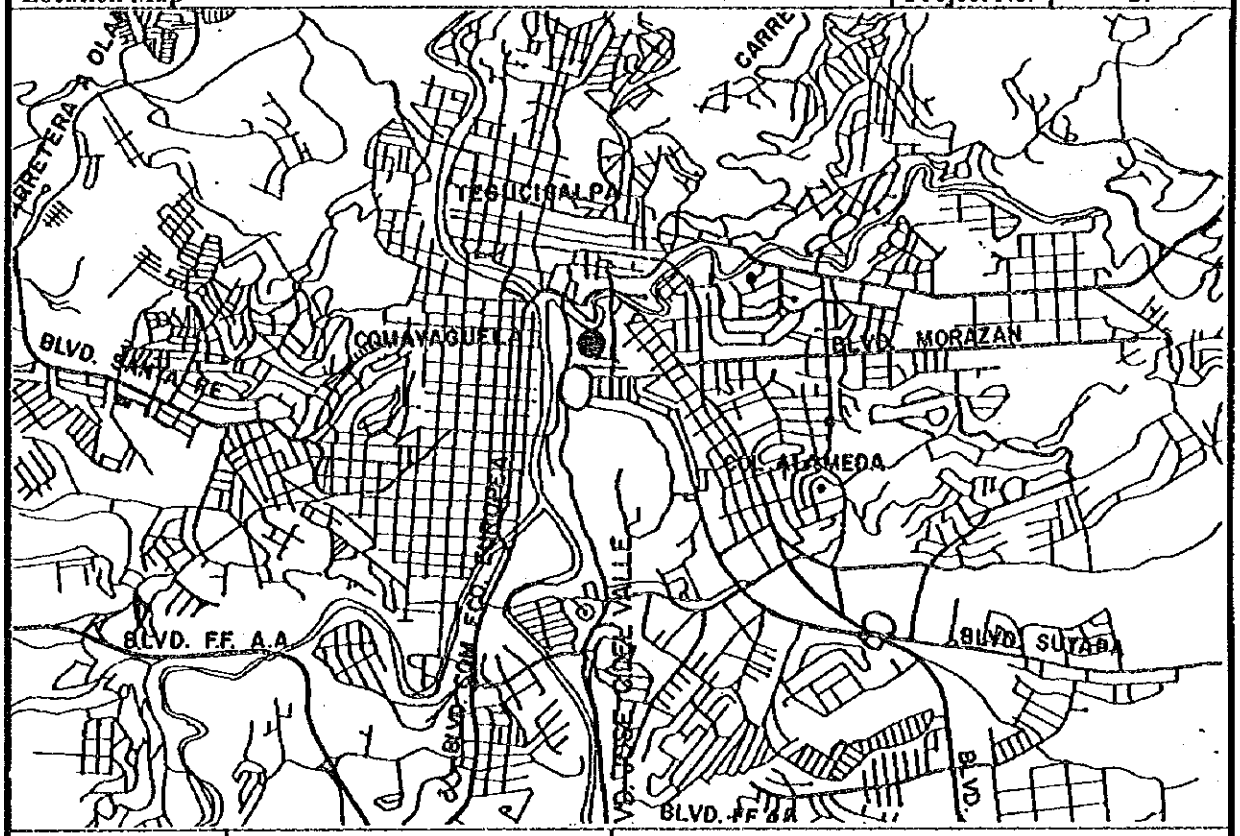
Characteristics	Name of Terminal	Las Brisas
	Function	Key Route - Ordinary
	D/A Passengers Demand	28,000 persons
	Facility Requirement (m^2)	6,240 m^2
No. of Lanes		–
Project Cost (1000US$)	Construction	360
	Land Aquisition,Resettlement	0
	Others	76
	Total	436
Proposed Construction Period		2001 (M)
Project Description	■ To connect key route urban buses of the North-South direction with the ordinary urban buses along the Middle Ring Road	

Location Map		Project No.	26



Characteristics	Name of Terminal	Estadio
	Function	Terminal Bus Center
	D/A Passengers Demand	74,900 persons
	Facility Requirement (m^2)	12,030 m^2
No. of Lanes		-
Project Cost (1000US$)	Construction	1,008
	Land Aquisition,Resettlement	0
	Others	212
	Total	1,220
Proposed Construction Period		2001 (M)
Project Description	■ To function as a central bus terminal for all the urban buses going through CBD	

Location Map		Project No.	27



Characteristics	Layout of Parking	Right angle, Backward
	Parking Lot	5.0 m (L) x 2.25 m (W)
	Roadway Width	6.0 m
	Parking Capacity	100 vehicles
	Facility Requirement (m^2)	990 m^2
Project Cost (1000US$)	Construction	653
	Land Aquisition,Resettlement	0
	Others	137
	Total	790
Proposed Construction Period		2006 - 2007 (L)
Project Description	■ To restrain the inflow of vehicles into the central area of Tegucigalpa by using a tract of land possesed by the municipality just outside the central area	

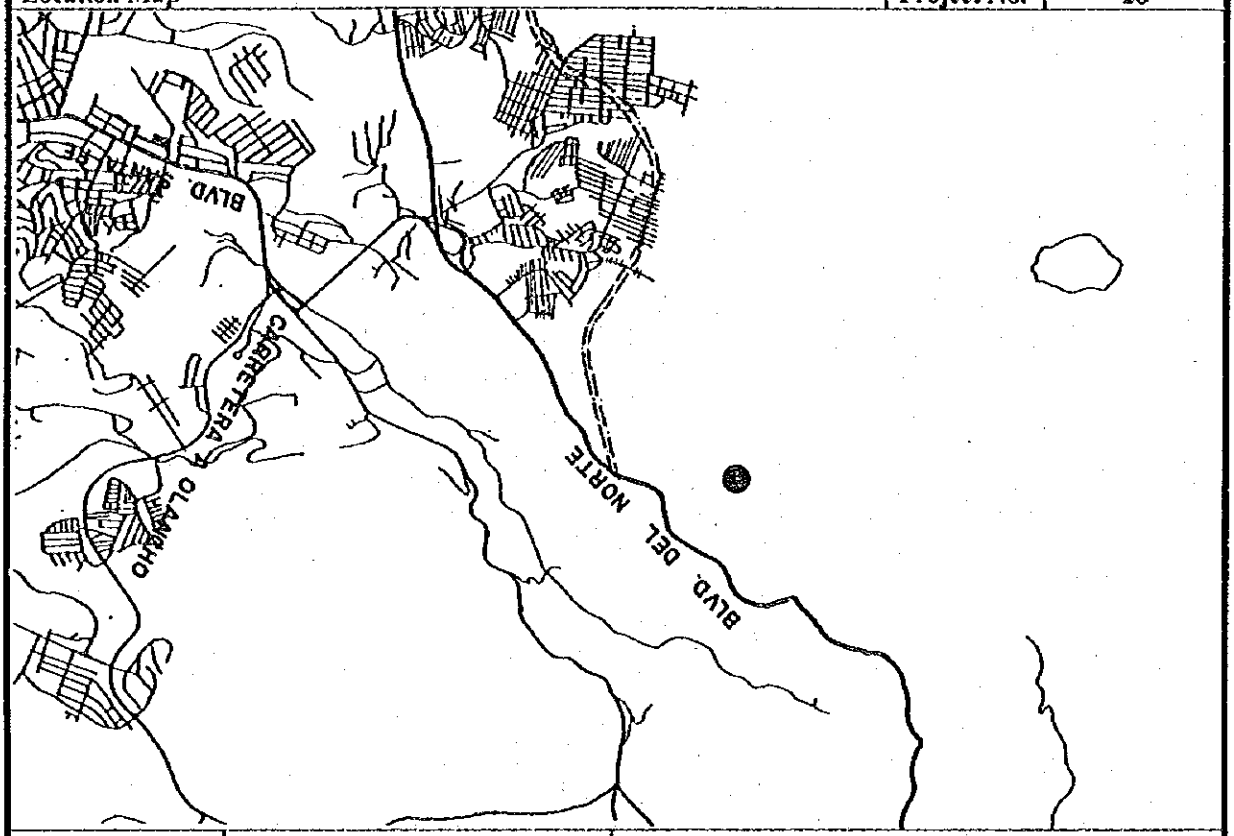
Location Map		Project No.	28
			
Characteristics	Number of berth	400	
	Width of Platform	25 m	
	Parking Lot	15 m (L) x 3 m (W) (at berth)	
		10 m (L) x 3 m (W) (for collection & delivery truck)	
	Roadway Width	8 m, 20 m, 10 m	
	Facility Requirement (m^2)	101,100 m^2	
Project Cost (1000US$)	Construction	6,430	
	Land Aquisition,Resettlement	0	
	Others	1,350	
	Total	7,780	
Proposed Construction Period		2006 - 2007 (L)	
Project Description	■ To mitigate the traffic congestion around the existing truck terminals by putting them together in Laguna El Pedregal		

Table 12.2.1 Implementation Program

Term	Category	Prjt. No.	Project Description	Project Length(m)	Total Cost (US$1,000)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Urgent	Improvement of Intersection	1	Configuration Improvement andTraffic Signal Installation at Intersection of Subida al Estadio National and the Circular Road of the National Stadium	-	28	28													
		2	Configuration Improvement at Intersection of Av. Cabanas and Blvd. Santa Fe	-	10	10													
		3	Configuration Improvement at Intersection in Front of Instituto Hondureno de Seguridad Social on Blvd. Comenidad Europea	-	318	223	95												
		4	Traffic Signal Installation at Intersection of Blvs. Jose Cecilio del Valle and Calle Golan	-	44	44													
		5	Approach Road Construction at Grade Separation of Blvd. Miraflores and Blvd. Fuerza Armadaz	-	165	116	50												
Short-term	Improvement & Construction of Roads	7	Road Improvement of Estadio Nacional - Blvd Morazan up to the Intersection of Juan Manuel Galves	600	2,662	2,662													
		8	Road Improvement of Calle Nickson - Calle 12 of the Central Area of Comayaguela - a new Bridge in the South of Puente de Juan Ramon Molino up to Blvd. Jose Cecilio de Valle.	2,520	3,248	650	1,624	974											
		9	Road Improvement of Calle Isla - Jose Cecilio del Valle	2,100	3,500		1050	1,400	1,050										
	Bridge Const.	(8)	Bridge to calle 12	-	incl. 8														
		11-1	Bridge to Av. 6	1,000	3,731		1,119	1,492	1,119										
Mid term	Improvement of Roads	6-2	Inner Ring Road Construction Surrounding the Central Area of Tegucigalpa (South Section)	1,390	9,520					4,760	2,856	1,904							
		11-2	Road Improvement of the Southern Section of Av. 6 - New Bridge - San Jose - Lomas de Toncontin	4,740	5,346						1,604	2,138	1,604						
		12	Road Improvement of Av. 8 in the Center ofComayaguela	1,860	4,245							1,274	1,698	1,274					
	Construction of Bus Terminals	21	Santa Fe	-	198														
		22	21 de Octubre	-	198														
		23	Miraflores	-	198														
		24	Aeropuerto	-	198														
		25	Las Brisas	-	436														
		26	Estadio	-	1,220														
	Bus Transportation	18	Introduction of Bus Exclusive Lanes	-	-														
		19	Introduction of Bus Exclusive Ways	-	-														
	Community Road	20	Introduction of Transit Mall	530	139														
Long-term	Improvement & Construction of Roads	6-1	Inner Ring Road (North Section)	2,230	4,226										1,690	1,690	845		
		10	Road Improvement of Blvd. Juan Manuel Galvez	1,790	8,146											3,258	3,258	1,629	
		13	Road Improvement of Anillo Periferico - Colonia La Fuente - Blvd. Fuerza Armadas	1,860	2,669											1,868	801		
		14	Road Construction and Improvement of Colonia San Jose de la Vega - La Canada - Anillo Periferico	2,380	3,150												1,260	1,890	
		15	Road Construction of Colonia Kennedy - Residential Plaza - Anillo Periferico	2,300	7,635													2,291	5,345
		16	Improvement of AnilloPeriferico - Colonia Loma de Jalcapa - Carretera a Oriente	3,115	5,243													3,146	2,097
	Parking Bldg.	27	Construction of Parking Building outside the CBD Area near Puente la Hoya		790														
	Truck Termina	28	Construction of Truck Terminal in Laguna el Pedregal		7,780														
				Annual cost		3,793	3,938	3,867	2,169	4,760	4,460	5,316	3,302	1,274	1,690	6,817	6,164	8,956	7,442

CHAPTER 13

ECONOMIC EVALUATION

CHAPTER 13 ECONOMIC EVALUATION

13.1 Objective

In the previous chapter road networks which should meet with the expected traffic demand by the year 2010 was established. To deal with the congestion due to the increase of vehicles in the central area of Tegucigalpa, some road improvement projects including the construction of new bridges are proposed in this Master Plan. The objective of the economic evaluation is to examine the feasibility of each project from the nation's economic viewpoint. Since these road improvement projects are not expected to bring income by providing services, they should be analyzed on the feasibility from the nation's economical viewpoints.

13.2 Projects to be Evaluated

The Master Plan formulated in the previous chapter consists of traffic management plan (which mainly consists of installation of traffic signals), road improvement plan and public transportation plan which proposes the introduction of bus exclusive lane etc. With regards to traffic management projects and public transportation projects proposed in this Master Plan, the effectiveness is considerable from the viewpoint of traffic safety and increase of comfort. In addition to this, not a great amount investment for execution of projects is necessary, therefore, road improvement projects which need large investment will be evaluated in this chapter. Table 13.2.1 shows a list of projects to be evaluated.

Table 13.2.1 Projects to be Evaluated

Project No.	Project Name	Road Length (m)
Project-6-1	Inner Ring Road Construction surrounding the Central Area of Tegucigalpa (north section)	2,230
Project-6-2	Inner Ring Road Construction surrounding the Central Area of Tegucigalpa (south section)	1,390
Project-7	Road Improvement of Estadio Nacional - Blvd. Morazán until the Intersection of Juan Manuel Galvas	600
Project-8	Road Improvement of Calle Nickson - Calle 12 of the Central Area of Comyaguela a new Bridge in the South of Puente de Juan Ramon Malipo up to Blvd. Jose Cecilio de Valle	2,520
Project-9	Road Improvement of Calle Isla - Jose Cecilio de Valle	1,765
Project-10	Road Improvement of Blvd. Juan Manuel Galves	1,790
Project-11-1	Av. 6 - New Bridge	1,000
Project-11-2	Road Improvement of the Southern Section of Av. 6 - New Breidge - San Jose - Lomas de Toncontin	3,910
Project-12	Road Improvement of Av. 8 in the Center of Comayagüela	1,860
Project-13	Road Improvement of Anillo Periférico - Colonia La Furente - Blvd. Fuerza Armadas	1,860
Project-14	Road Construction and Improvement of Colonia San Jose de la Vega - La Canada - Anillo Periférico	2,380
Project-15	Road Construction of Colonia Kenedy - Residental Plaza - Anillo Periférico	2,300
Project-16	Improvement of Anillo Periferico - Colonia Loma de Jaleapa - Carretera a Oriente	3,115

13.3 Evaluation Method

Economic evaluation of each project is executed by comparative assessment of the accumulated benefit to the required cost in economic term by project. The benefit yielded by the projects' implementation is estimated by making comparison between "With-case" and "Without-case".

"With-case" means implementation of the particular project and "without case" means that the future increasing traffic demand would be dealt with the existing road network. For the convenience of this evaluation, all the projects are assumed to start in 1997, and the evaluation period is fixed for 14 years from 1997 to 2010 when the traffic demand is forecast.

1. Calculation of each project's actual cost and economic cost (incl. maintenance cost)
2. Estimation of annual investment amount of each project
3. Estimation of Vehicle Operation Cost and Time Value by Vehicle Type
4. Calculation of total running km and total travel time in 2010 for the "with-case" and "without-case"
5. Calculation of annual cost and benefit until 2010, and accumulated cost and benefit discounted by social discounted ratio
6. Estimation of evaluation indicators (EIRR: Economic Internal Rate of Return, NPV : Net Present Value, B/C: Cost Benefit Ratio)

13.4 Project Cost and Economic Project Cost

Each project cost calculated by market price in Honduras is divided into foreign portion and local portion which respectively means cost depending on imported materials and materials to be procured domestically. In this evaluation 53% and 47% are adopted to foreign portion and local portion respectively, referring to other projects in Honduras. For the evaluation, All the tax portion, which should be treated as transfer item for the government was deducted from each project cost by using tax rates shown in Table 13.4.1 Investment schedule in market price and economic project costs for each project are shown in Table 13.4.2.

Table 13.4.1 Tax Rates in Honduras

Item	Article	Rate(%)
Sales Tax		7.0
Import Tax		
	Motor Car	41.5
		58.5
		63.5
	Bus	18.5
	Pick-up	13.5
		18.5
	Truck	12.0
	Gasoline	23.5
	Oil	23.5
	Heavy Construction Machine	13.5
	Asphalt	13.5
	Cement	13.5
	Iron	13.5, 23.5

Table 13.4.2 Economic Cost of Each Project

(Unit: Lps1000)

Year / Project No.	1	2	3	Total Cost	Economic Cost
Project 6-1	24,722	14,833	9,889	49,444	43,297
Project 6-2	48,261	48,261	24,310	121,551	83,941
Project 7	31,145	-	-	31,145	27,273
Project 8	7,600	19,001	11,400	38,002	33,277
Project 9	12,285	16,380	12,285	40,950	35,858
Project 10	38,123	38,123	19,062	95,308	83,458
Project 11-1	13,096	17,461	13,096	43,653	38,225
Project 11-2	18,764	25,019	18,764	62,548	54,771
Project 12	14,900	19,867	14,900	49,667	43,491
Project 13	21,859	9,368	-	31,227	27,345
Project 14	14,742	22,113	-	36,855	32,273
Project 15	26,799	62,531	-	89,330	78,223
Project 16	36,806	24,537	-	61,343	53,716

13.5 Maintenance Cost

Annual maintenance cost of each project is estimated to be 0.17% of each project cost, referring to other projects in Honduras. Annual maintenance cost by project is estimated as shown in Table 13.5.1. As well as the project cost this cost is converted into economic cost for the evaluation.

Table 13.5.1 Maintenance Cost by Project

(Unit : 1000Lps)

Project No.	Annual Maintenance Cost	Economic Annual Maintenance Cost
Project 6-1	84	74
Project 6-2	162	143
Project 7	53	46
Project 8	65	57
Project 9	70	61
Project 10	162	142
Project 11-1	74	65
Project 11-2	106	93
Project 12	84	74
Project 13	53	47
Project 14	63	55
Project 15	152	133
Project 16	104	91

13.6 Estimation of Vehicle Operation Cost

1) Unit cost of Vehicle Operation Cost by Vehicle type

Unit cost of vehicle operation cost by vehicle type was calculated by using following basic data as shown in Table 13.6.1 collected in Tegucigalpa in this study in corporation with

Table 13.6.1 Basic Data for Vehicle Operation Cost

Item		Passenger Car	Bus	Taxi Colectivo	Taxi
		TOYOTA	HINO	TOYOTA	TOYOTA
		COROLLA	AK174S	TERCEL	TERCEL
Price of Vehicle	Lps	162,750	617,13.25	138,863	138,863
Annual Mileage	km	13.,000	32,000	36,000	36,000
No. of Tires/Veh.	wheel	4	6	4	4
Life Span of Vehicle	year	10	5	10	10
Life Span of Tire	year	1	1	1	1
Residual Value	%	10	10	10	10
Insurance Cost/year	Lps	6,510	24,717	5,555	5,555
No. of Crew/vehicle	Per.	0	2	1	1
Salary of Driver/year	Lps	0	24,000	18,000	18,000
Salary of Assistance/year	Lps	0	15,000	0	0
Maintenance Cost /veh./year	Lps	400	1,200	600	600
Office Admini. Cost /veh./year	Lps	0	800	400	400
Interest Rate/year	%	30	30	30	30
Price of Gasoline/litter	Lps	3.13.5	3.15	3.13.5	3.13.5
Price of Oil/litter	Lps	23.25	23.25	23.25	23.25
Import Tax					
Tax for Vehicle	%	41.5	18.5	41.5	41.5
Tax for Gasoline or Diesel	%	23.5	23.5	23.5	23.5
Tax for Oil	%	23.5	23.5	23.5	23.5
Tax for Tire	%	13.5	13.5	13.5	13.5
Sales Tax					
Sales Tax	%	7	7	7	7
Economic Price					
Price of Vehicle	Lps	107,413.3	487,342	13.1,716	13.1,716
Price of Gasoline	Lps	3.0	2.4	3.0	3.0
Price of Oil	Lps	17.6	17.6	17.6	17.6
Price of Tire	Lps	452	1,613.5	553	553

As well as economic project cost, unit cost of vehicle operation cost should be converted into economic price using following tax rate in Honduras as shown in Table 13.4.1.

2) Annual Vehicle Operation Cost Saving

By using the calculated unit cost of vehicle operation, total saving of vehicle running distance and travel time on the network (by project), benefit on vehicle operation cost saving in 2010 was estimated, and this benefit from 2001 to 2010 was calculated by proportional distribution. Annual vehicle operation cost saving by project is shown in Table 13.6.2.

Table13.6.2 Vehicle Operation Cost Saving (2010)

(Unit: 1,000Lps)

Project No.	VOC Saving in 2010
Project 6-1	11,663
Project 6-2	-1,937
Project 7	22,914
Project 8	27,868
Project 9	57,610
Project 10	27,441
Project 11-1	12,029
Project 11-2	13,153
Project 12	18,799
Project 13	27,692
Project 14	12,973
Project 15	37,425
Project 16	4,333

13.7 Travel Time Cost Saving

Enhancement of the road network by new road construction, bridge construction and widening of the road will reduce the travel time of vehicles on the network comparing the existing road network. This reduction of the total travel time in the urban transportation plan shares considerable portion of the benefit. It is reasonable from the objective of the plan which aimed to reduce the congestion in the urban area. As a result of the traffic assignment to the proposed network based on the traffic forecast in 2010, total travel time is calculated for each project. Comparing these total travel-time with that in the case of no project, the difference is grasped as travel time saving and it is counted as a benefit. By using estimated time value based on the person trip survey data conducted in this study in Tegucigalpa, total travel time saving is converted into monetary terms. Time value by vehicle type is estimated by the following steps, and the result is shown in Table 13.7.1.

1) Average monthly income per person is estimated by the data regarding the income per home and average number of person per home obtained in this person-trip survey.
2) Average number of passengers with business-trip purpose by vehicle type is calculated
3) Monthly value of each vehicle type is calculated by multiplying 1) and 2), then hourly value of each vehicle type is calculated by dividing this figure by average working hours per month.

Table 13.7.1 Time Value by Vehicle Type

Type of Vehicle	Average Occupancy (A)	Business Purpose (B)	(A)*(B)	Average Personal Income	Time Value/Veh. /month	Time Value/Veh. /hour
unit	persons	(%)	persons	Lps/mon	Lps/mon	Lps/h
Private car	2.1	59%	1.239	1,172	1,453	8.3
Bus	36.0	49%	17.64	504	8,896	50.5
Taxi (col.)	3.0	55%	1.65	504	832	4.7
Taxi (priv)	3.0	55%	1.65	504	832	4.7

Travel time cost saving in 2010 is estimated by multiplying the time value and time saving as shown in Table 13.7.2.

Table13.7.2 Travel Time Cost Saving (2010)

(unit: 1,000Lps)

Project No.	Travel time Cost Saving in 2010
Project 6-1	31,752
Project 6-2	29,727
Project 7	35,425
Project 8	32,839
Project 9	40,640
Project 10	34,985
Project 11-1	30,922
Project 11-2	36,446
Project 12	33,085
Project 13	37,290
Project 14	29,256
Project 15	34,586
Project 16	28,207

13.8 Evaluation

Annual cost and annual benefit of each project until 2010 are summarized as a cash flow table (refer to Appendix 13.1). Using these cash flows, Economic Internal Rate of Return (EIRR) is calculated, Net Present Value (NPV) and Cost Benefit Ratio (B/C) of each project are calculated by discounting the annual cost and benefit with the social discount rate in Honduras. 12% is adopted as a discount rate, referring to previous projects. The calculated indicators are shown in Table 13.8.1.

Table13.8.1 Result of Evaluation

Project No.	EIRR (%)	NPV(1000Lps)	B/C
Project 6-1	16.24	1,160,000	1.33
Project 6-2	13.64	811,000	1.12
Project 7	46.95	10,900,000	5.42
Project 8	36.38	8,160,000	4.03
Project 9	46.25	15,000,000	6.18
Project 10	19.72	4,430,000	1.66
Project 11-1	26.35	4,420,000	2.43
Project 11-2	22.71	4,330,000	1.98
Project 12	27.70	5,670,000	2.61
Project 13	46.05	10,900,000	5.67
Project 14	31.20	5,610,000	3.04
Project 15	24.91	8,050,000	2.21
Project 16	16.8	1,710,000	1.37

All the projects are evaluated to be feasible judging from calculation of evaluation indicators.
Projects 7, 8, 9, which are road improvement project in the central area with large traffic volume and severe congestion at present; and project 13 and 14, which are the construction and improvement of roads passing toward central area from developing area in southern and western parts, yield a high figure of IRR. These projects are judged to be effective to traffic improvement in Tegucigalpa.
Project 11-1, 11-2, which take a role of bypass of Blvd. Comunidad Europea, and project 12, which is expected to secure the general traffic overflow resulting from the introduction of the bus way, and project 15 which will secure the access from the residential area to Blvd. Miraflores and Anillo Periferico, yield a relatively high IRR figure.
Project 6-1, 6-2 do not yield such high figures of IRR, however, but they will make a great contribution to mitigation of congestion within the "Centro" and to conservation plan for tourism the "Centro"
Project 10 also does not yield such a high figure of IRR; however, it will contribute to the dispersion of commercial activities around the Blvd. Suyapa and Blvd. Miraflores from central area.
Project 16 with not so much high figure of IRR will mitigate the congestion on Blvd. Fuerzas Almadas caused by commuters from southeast area.

13.9 Sensitivity Analysis

Project costs and benefits could be changed by several factors due to the unexpected socio-economic changes. In this analysis the influence to EIRR calculated in the previous section is analyzed in acordance with the fluctuation of some factors. Sensitivity to the 20% increase of project costs and to the 20% reduction of total benefit is examined

Table 13.9.1 The result of Sensitivity Analysis

Project No.	Basic Case	20% Increase of Cost	20% Reduction of Benefit
	EIRR(%)		
Project 6-1	16.24	13.50	12.32
Project 6-2	13.64	10.86	12.61
Project 7	46.95	41.70	44.39
Project 8	36.38	32.59	34.24
Project 9	46.25	41.85	43.11
Project 10	19.72	16.82	18.16
Project 11-1	26.35	23.11	25.22
Project 11-2	22.71	19.65	21.71
Project 12	27.70	24.38	26.22
Project 13	46.05	41.29	43.56
Project 14	31.20	27.53	29.79
Project 15	24.91	21.64	22.82
Project 16	16.8	13.99	16.33

From the result of calculation of IRR shown in the Table 13.9.1, all the projects are judged to be feasible against 20% reduction of total benefit which is caused by estimation errors. However, against the 20% increase of the project cost, IRR of project 6-2 indicates 10.86%, therefore it is

difficult to judge project 6-2 to be sufficiently feasible. As project 6-2 is considered to be very important from other points of view mentioned above, the detailed plan for the execution should be established after due consideration.

CHAPTER 14

MEASURES FOR PROJECT IMPLEMENTATION

CHAPTER 14 MEASURES FOR PROJECT IMPLEMENTATION

14.1 Fund Source

14.1.1 Fund Source for Road Projects in Tegucigalpa

At present, road projects in Tegucigalpa are controlled by the municipality and SECOPT. The municipality controls all road projects in the city except bridge projects for which both the municipality and SECOPT are responsible. Comite Vial functions as a agency for small-scale projects such as intersection improvements, installation of traffic signals and traffic signs by the funding from fines. Funds for road projects are derived from the general revenue of the municipality and the national government. There are no earmarked funds which are exclusively used for road works. The budget of SECOPT relating to road works has been decreasing over the last 3 years, and less than one hundred million Lempiras are allocated to road works not including foreign fund as shown in Table 14.1.1. Over the last few years, the municipality's roadworks budget has averaged around thirty million per year. The cost for executing the projects presented in this Master Plan, is estimated every year from 1997 to 2010 as shown in Table 14.1.2. Average annual cost is fifty five million Lempiras if total cost is divided equally by number of years.

Table 14.1.1 Budget of SECOPT and Road Division

(UNIT: Lps1000)

YEAR	NATIONAL FUND	FOREIGN FUND	TOTAL
SECOPT			
1993	378,137	353,558	731,395
1994	467,036	509,501	976,536
1995	315,195	764,316	1,079,511
DIRECCION GENERAL DE CAMINOS			
1993	126,783	353,258	480,041
1994	113,252	202,477	315,729
1995	93,338	115,343	208,681

Table 14.1.2 Annual Cost for Execution of Master Plan

(UNIT: Lps1000)

Year	Amount	Year	Amount
1997	43,604	2004	38,631
1998	46,287	2005	14,900
1999	45,242	2006	48,621
2000	25,381	2007	108,603
2001	24,722	2008	113,343
2002	33,598	2009	140,511
2003	49,808	2010	24,537

14.1.2 Means for Procurement of Funds

As for the means for procurement of funds for the execution of projects proposed in the Master Plan, the following possibilities will be considered:

1. Increase of SECOPT and municipality's budget
2. Establishment of earmarked funds for road works such as introduction of gasoline tax and motor vehicle tonnage tax based on the concept that the road users enjoying the benefits of

improved roads should share the burden of improvement.

3. Establishment of a city planning tax system and development of tax based on the concept that a part of benefits which landowners enjoy due to the increase of land prices caused by road improvement should be returned to the public
4. Loans and donations from international fund agencies such as IBRD, IDB, CABEI, etc.

Ways and means mentioned above are studied in the following parts regarding possible amount to be procured.

1) Secure of Budget in Municipality and SECOPT

Judging from the figures of the municipality's budget mentioned above, it would be impossible to execute the projects proposed in the Master Plan salely through municipality funds. The road division in SECOPT conducts nationwide road projects. About 10% of its budget is invested into Tegucigalpa and Comayagüela, amounting to ten million Lempiras. Considering that SECOPT and the municipality take a positive attitude toward this Master Plan, it will be possible to allocate 5% more budget for its execution. Therefore about fifteen million Lempiras can be secured by SECOPT. On the other hand, the municipality cannot afford to increase its budget. However, along with SECOPT, the municipality strongly promotes the Master Plan, and about one third of its budget can be allocated to its execution. Accordingly, ten million Lempiras in the municipality and fifteen million Lempiras in SECOPT; a total of twenty five million will be reserved for the Master Plan. Thirty million Lempiras need to be procured from other fund sources.

2) Introduction of City Planning Tax

Execution of projects proposed in the Master Plan will cause an increase in the price of land around the areas involved. It is usually said that about 80 % of the influence of traffic investment in urban area appears in land price. Almost all of the benefit from this land price increase returns to landowners, not to road users. It will be recommendable to levy a tax on the landowners based on the concept that the benefit from development due to the road improvement should be returned to the public. The revenue from this taxation should be used exclusively for the promotion of the Master Plan.

Residential areas, commercial areas and industrial areas to be taxed in this study were estimated in chapter 8 as shown in the Table 14.1.3. As authorized land price does not exist in Tegucigalpa, the average land price in the urban area is estimated at one hundred twenty Lempiras per square meter based on the land acquisition data used for the cost estimate. The revenue from this taxation is estimated at Lps 10,795,000 and Lps. 15,562,000 in 1995 and in 2010 respectively on the assumption that the tax rate is fixed at 0.2% of the land price as shown in Table 14.1.4.

Table 14.1.3 Land Use Area

(Unit: ha)

Year	1995	2010
Residential Land	3,441	4,878
Commercial Land	987	1,483
Industrial Land	70	123
Total	4,498	6,484

Estimated in this Study

Table 14.1.4 Revenue of City Planning Tax

(Unit: 1000Lps)

Year	1995	2010
Revenue by City Planning Tax	10,795	15,562

3) Introduction of Development Tax

Urban development in the study area leads to an increase of traffic volume therein. As a matter of course, this generated traffic would pass on the roads improved or constructed in this Master Plan. Developers would enjoy various benefits by using these roads. Introduction of development tax is desirable based on the concept that these developers should share the burden for the road investment that brings them benefits. Normally, developers share the burden in accordance with the increase of traffic resulting from development. It is difficult to make precise calculations, so in this study, 5% of the sale price of lands is applied as the tax rate. As shown in Table 14.1.3, the area to be developed by 2010 is estimated to be 1,986 ha, therefore 132 ha will be developed annually on condition that the development is carried out equally every year. The revenue of development tax is estimated to be 7,920,000 Lempiras every year until 2010 as shown in Table 14.1.5.

Table 14.1.5 Revenue of Development Tax

(Revenue unit: 1000Lps)

Year	Developed Area	Unit Price/m^2	Tax Rate	Total Revenue
Revenue by Development Tax	1,320,000 m^2	120 Lps.	5%	7,920

4) Introduction of Gasoline Tax

At the present, 23.5% of the price of gasoline and diesel fuel is import tax and 7 % is sales tax in Honduras. The revenue of from import and sales taxes are treated as general revenue. Introduction of gasoline tax as an earmarked fund for road improvement is desirable based on the popular concept that road users should share the burden with the cost of road improvement. The strong point of this taxation is to be able to execute road improvement continuously and steadily by exclusive use of funds. This type of taxation is applied in many countries as earmarked fund for road works. As shown in the Table 14.1.6, tax rate is comparatively high in other countries except United States of America. At the present, tax portion of the gasoline price in Honduras is about 25%. If this percentage is raised by 5% to 30%, 0.32 Lempiras per litter, which means raising the gasoline price by 8 %, is secured as gasoline tax. Revenue of gasoline tax is estimated at 27,631,000 Lempiras and 81,760,000 Lempiras in 1995 and in 2010 respectively for the study area, as shown in the Table 14.1.7.

Table 14.1.6 Fuel Tax Rate

(Unit: US$/liter)

	Gasoline			Diesel		
	Price	Tax	Tax Rate	Price	Tax	Tax Rate
U. S. A	0.232	0.064	27.5%	0.235	0.085	36.1%
England	0.627	0.419	66.8%	0.586	0.393	67.0%
France	0.794	0.615	77.5%	0.535	0.346	65.2%
Germany	0.508	0.343	67.5%	0.505	0.325	64.4%
Japan	0.932	0.433	46.4%	0.550	0.201	36.6%
Honduras**	0.369	0.090	24.3%	0.294	0.071	24.3%

*1988 Japan Energy Economic Institute

** Data of Honduras is for 1996 (US$1=Lps10.7)

Table 14.1.7 Revenue of Gasoline Tax

Year	Total Annual Vehicle Running Distance (1000km)	Fuel Efficiency (l/km)	Annual Fuel Consumption (1000l)	Gasoline Tax (Lps/l)	Total Revenue (Lps1000)
1995	863,482	0.1	86,348	0.320	27,631
2010	2,555,000	0.1	255,500	0.320	81,760

5) Introduction of Motor Vehicle Tonnage Tax

The principal concept for roadwork funding is based on the concept that those who will benefit must share that burden of the cost of road improvement as mentioned before. Furthermore, the idea that those who damage the road must share the burden of cost is also an important concept. Consequently, motor vehicle tonnage tax is desirable for the fund. Generally, road damage significantly depends on the motor vehicle tonnage. Tax rates should be established according to vehicle tonnage and types of vehicle use. In this study, 100 Lempiras per vehicle per year is applied to the tax for convenience. The number of registered vehicles in the study area was 63,140 in 1994, and about 186,000 vehicles are forecast for 2010. Therefore, the revenue of this tax is estimated to be 18,600,000 Lempiras in 2010.

6) Foreign Funds

Foreign funds should only be applied in the case of acute lack of domestic funds, as mentioned above, as foreign funds concur future debt. International lending agencies such as BECIE IDB, BIRF are recommendable based on previous records in Honduras. It is recommended that the municipality make efforts to seek international or bilateral fund sources with lower interest rates.

14.1.3 Fund Source Plan

Considering the several fund sources mentioned above, fund allocation is planned as shown in Table 14.3.1. In planning the fund source, the following points are taken into consideration.

1) As it would take considerable time to make a trial calculation or to introduce any kind of tax system, commencement of city planning tax, development tax, gasoline tax and vehicle motor tonnage tax systems should be the year 2000, 2000, 2002 and 2003 respectively.
2) All the roads within the city should be controlled and financed by the municipality except for

special roads such as "anillo periférico" Accordingly, after the year 2000 when city planning tax and development tax will begin, the budget should be secured by the municipality alone.

3) As the introduction of foreign funds will lead the municipality into debt in the future, such will only be applied for the years 1997 to 1999 and 2009, when the funds for this Master Plan would be insufficient from other fund sources. In this study an interest rate of 8%, determent period of three years, and repayment period of 20 years are applied under consideration of CABEI financing.

Table 14.1.8 Fund Source Plan

(Unit: Lps1000)

Year	Project Cost	Road Revenue		Tax				Foreign Fund	Total Revenue	Repay-ment	Balance
		Mun.	SCOPT	Plan.	Delpmt.	Gasoline	Tonnage				
1997	43,664	10,000	15,000	0	0	0	0	14,932	43,664	0	0
1998	46,075	10,000	15,000	0	0	0	0	17,137	46,075	0	0
1999	45,244	10,000	15,000	0	0	0	0	16,377	45,244	0	0
2000	25,377	10,000	0	12,384	7,920	0	0	0	32,473	-1,754	5,342
2001	55,692	10,000	0	12,702	7,920	0	0	0	84,689	-3,762	25,235
2002	52,182	10,000	0	13,020	7,920	52,913	0	0	88,313	-5,671	30,460
2003	62,197	10,000	0	13,337	7,920	56,518	12,867	0	105,958	-5,671	38,090
2004	38,633	10,000	0	13,655	7,920	60,124	13,686	0	108,687	-5,671	64,383
2005	14,906	10,000	0	13,973	7,920	63,730	14,505	0	111,402	-5,671	90,825
2006	19,773	10,000	0	14,291	7,920	67,336	15,324	0	116,561	-5,671	91,117
2007	79,759	10,000	0	14,609	7,920	70,942	16,143	0	126,431	-5,671	41,001
2008	98,924	10,000	0	14,926	7,920	74,548	16,962	0	132,811	-5,671	28,217
2009	101,785	10,000	0	15,244	7,920	78,154	17,781	0	138,055	-5,671	27,599
2010	87,071	10,000	0	15,562	7,920	81,760	18,600	0	141,284	-5,671	48,542

The following advantages are considered for promoting the road improvement based on the funds earmarked for road works, such as gasoline tax.

1. Effective allocation of resources can be carried out by reflecting the needs of road improvement to road investment.
2. Impartiality of taxpayers will be secured based on the concept that those who enjoy the benefit should share the burden of cost of road projects.
3. Road improvement can be executed systematically by steady and continual funding.
4. It is very easy for taxpayers to understand the objective of the tax, which is specified for the road improvement.

Consequently, it is recommended that the municipality appeal to the related agencies and organizations to fulfill the earmarked fund system as soon as possible.

14.2 Organization for Implementation

Tegucigalpa Municipality that is the enforcement agency, should be considered to reform the organization in Municipality to implement selected projects. Especially, at present several national government organizations are involved in the civil work projects in the study area because of lack of funds as well as planning and engineering staff in the Municipality. It is desired that as many necessary civil work projects be performed by the Municipality for itself as possible. For this

purpose, it is concluded that the organization of the Municipality related to the transportation and city planning should be reformed as shown in Fig 12.3.1, that is, under the mayor the Urban Development Division is strengthened and all the basic policy of the city planning and transportation is determined together with representative from SECOPT, SANAA, AMDC, EUEE, etc. As for the concrete implementation of the policy, the following departments are in charge under this division.

- MANAGEMENT OF METROPLAN takes a role of the city planning
- MANAGEMENT OF TRANSPORT AND VIAL MATTERS is in change of the road planning
- MANAGEMENT OF MARKETS is change of market planning

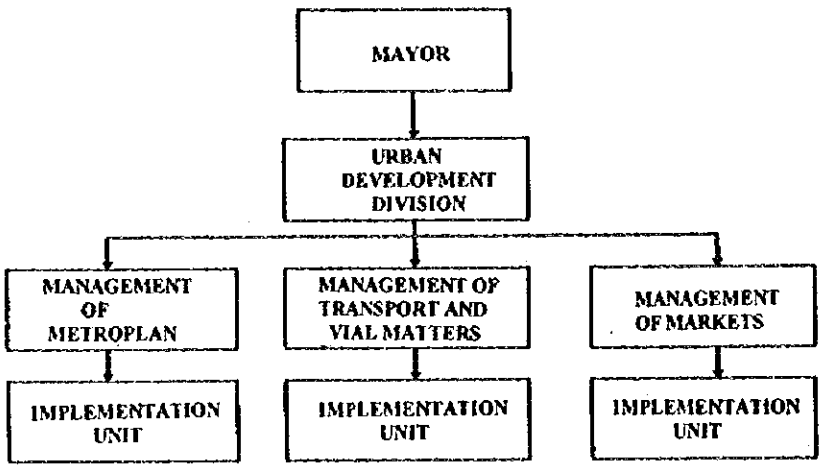


Fig. 14.2.1 Proposed Organization Related to Transportation

Structure of "the Management of Transportation and Vial Matters" is proposed as follows:
To achieve its attributions and objectives, "the Management of Transportation and Vial Matters" is organized in five general departments as shown in Fig.12.3.2.
For the adequate performance of the these department it is necessary a good organization of the management.

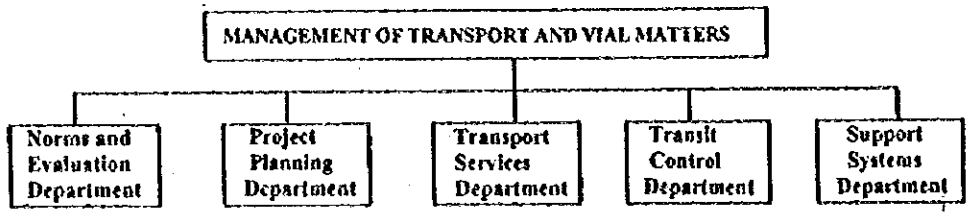


Fig.14.2.2 Organization of "the Management of Transportation and Vial Mattes"