

REPUBLIC OF GUATEMALA

MASTER PLAN STUDY
ON

***THE COMPREHENSIVE URBAN
TRANSPORTATION SYSTEM***

IN
GUATEMALA METROPOLITAN AREA

EXECUTIVE SUMMARY

MARCH 1992

***JAPAN INTERNATIONAL
COOPERATION AGENCY***



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Preface

In response to a request from the Government of the Republic of Guatemala, the Government of Japan decided to conduct a master plan study on the Comprehensive Urban Transportation System in Guatemala Metropolitan Area and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Guatemala a study team headed by Mr. Takeshi Yoshida, Yachiyo Engineering Co., Ltd., three times between March 1990 and December 1991.

The team held discussions with the officials concerned of the Government of the Republic of Guatemala, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Guatemala for their close cooperation extended to the team.

March, 1992



Kensuke Yanagiya
President
Japan International Cooperation Agency

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Study Organization Members

1. OUTLINE OF THE STUDY

Study Development

In response to the request of the Government of the Republic of Guatemala, the Government of Japan, through the Japan International Cooperation Agency (JICA), initiated a Master Plan Study on the Comprehensive Urban Transportation System in Guatemala Metropolitan Area (called ESTUAM).

The preliminary study team, headed by Dr. Hisao Uchiyama, was dispatched by JICA to Guatemala and the Scope of Work for the Study was agreed on November 1991.

The site study in Guatemala began on July 1990 and continued up to December 1991.

Study Purpose

The objectives of the study are as follows;

- 1) To formulate a Master Plan on the Comprehensive Urban Transportation System in Guatemala Metropolitan Area
- 2) To recommend an Urgent/Short Term Development Plan to be formulated within the framework of the Master Plan.
- 3) To transfer relevant technology to Guatemala counterpart personnel in the course of the Study.

Scope of the Study

1) Target Year

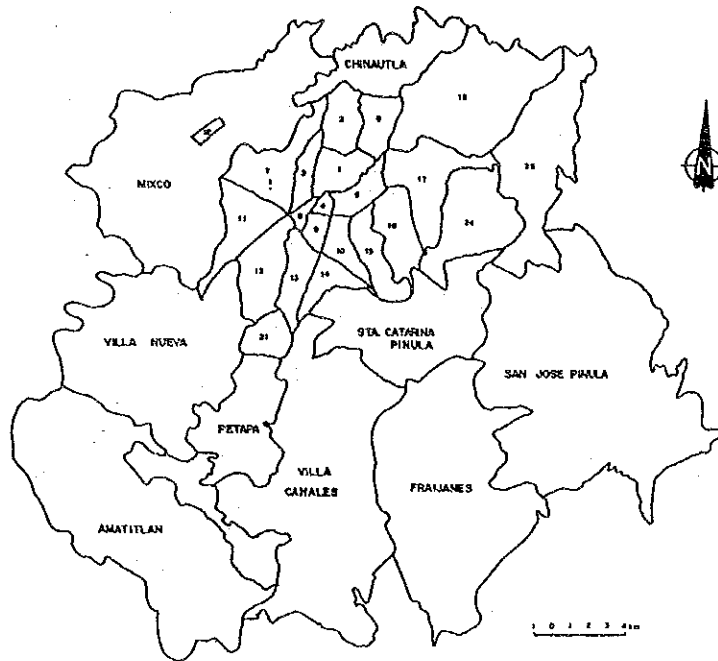
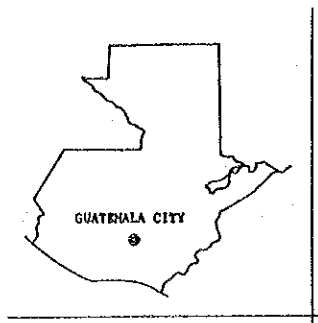
The year 2010 is defined as the target year for the Master Plan Study, and the year 1995 will be adopted as the target year for the Urgent/Short Term Development Plan.

2) Study Area

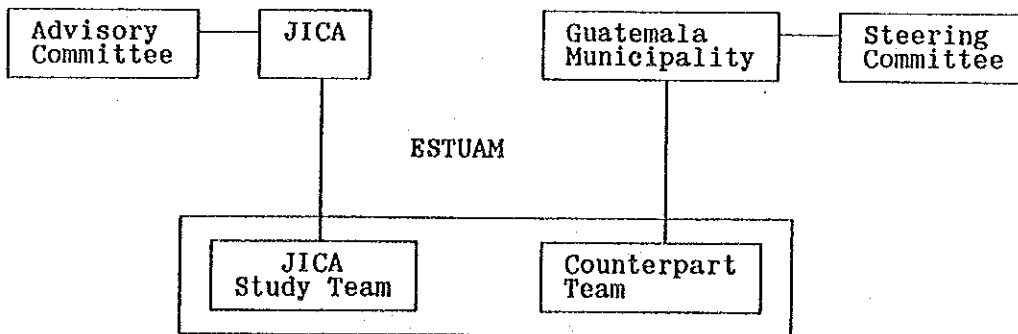
The Study Area covers Guatemala City and the area it influences, such as Mixco, Villa Nueva, San Miguel Petapa, Sta. Catarina Pinula, Chinautla, Amatitlan, Villa Canales, Fraijanes and San Jose Pinula.

Study Organization

To conduct the Study, JICA has organized both the Study Team, headed by Mr. Takeshi Yoshida and the Advisory Committee, chaired by Dr. Hisao Uchiyama, to receive the advice for the Study. The government of Guatemala has formed the Counterpart Team, headed by Mr. Edgar De Leon under Guatemala Municipality. Guatemala Municipality has organized the Steering Committee, consisting of Guatemala Municipality, Ministry of Planning, Ministry of Communication, Transport and Public Works, National Police, Housing Bank and Guatemala Railway.



Study Area



Study Organization

2. SOCIO-ECONOMIC BACKGROUND

A Profile

The republic of Guatemala is the nation, which has the border with Mexico to North and West, Belize to North, Honduras and El Salvador to East, having a national territory of 108,889 square kilometers, and a population of 9,197 thousand (1990 estimated). The Study Area is located on a plateau of approximately 1500 meters above sea level in the center of the nation, and area of 937 square kilometers. The geological features are composed of volcanic diluvial rock susceptible to erosion, which have created many deep valleys cutting into the hilly area.

Guatemala City has grown up as the nation's Capital, as an economic, financial, social, and cultural center and also as the center of Central America.

Population

The population of the Study Area increased from 1.35 million in 1981, to 1.8 million by 1990, at an average annual rate of 3.3%. Guatemala City's population of 1,030,000 in 1990 accounted for 47% of the Study Area's total population.

Economic Conditions

The primary sector can be almost totally ignored in the Study Area, while the secondary and tertiary sectors account for over half of the national economy. The Study Area's gross regional product (GRP) in 1990 was estimated as 1.8 million quetzales at 1958 prices, and the resulting GRP per capita was 1,014 quetzales.

Land Use

Because of the hilly topographic features, almost half of the total area of the Study Area lies on a gradient of 30% or more. The total area of the urban area is 25 thousand hectares, which includes land prepared for urbanization but not occupied.

Population and Employment

Area	Population		Annual Increase Rate (%)
	1981 ¹⁾	1990 ²⁾	
Guatemala City	865,200 (64.3)	1,034,400 (57.4)	2.00
Mixco	226,800 (16.8)	335,000 (18.6)	4.43
Villa Nueva	81,500 (6.1)	225,400 (12.5)	11.97
Others	171,800 (12.8)	206,100 (11.5)	2.04
Total	1,345,300 (100.0)	1,800,900 (100.0)	3.29

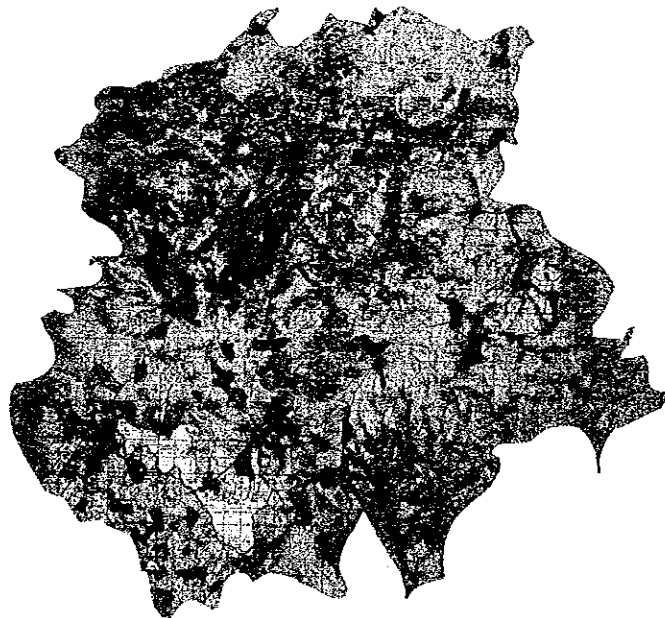
Note:

- 1) Corrected Population of 1981 Census
- 2) Study Team Estimation

Employment by Sector

Sector	Employment	Percentage
Primary	16,300	2.6
Secondary	149,800	23.5
Tertiary	470,800	73.9
Total	636,900	100.0

Source: Person Trip Survey



SABOLOGIA

1 COMERCIAL Y DE NEGOCIOS	
2 INDUSTRIAL	
3 RESIDENCIAL	
4 SEMI-URBANO	
5 INSTALACIONES PUBLICAS	
6 USO MIXTO	
7 AGROPECUARIA	
8 RECREACION	
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19 NIVEL 3: DISTRITO CENTRAL DE NEGOCIOS	

Present Land Use

3. THE PROBLEMS IN URBAN TRANSPORT

Overall Urban Transportation Problems

- 1) The trend of increasing trip distance caused by urban expansion under the Study Area's topographical constraints.
- 2) Traffic congestion in particular areas as a result of the traffic concentration on the few arterial of the road network.
- 3) Increase in traveling distance for commuting to work and school trips and also increase of the time of these trips due to the traffic congestion.
- 4) Lack of suitable service provided by buses and minibuses which are the only public transportation service available.
- 5) High frequency of traffic accidents indicates decrease in traffic safety.
- 6) Pollution along the arterial roads caused by the noise and exhaust gas of vehicles.
- 7) Insufficient organization and management to provide safe and reliable transportation service.
- 8) In the absence of new investments, lack of finances to maintain and rehabilitate existing facilities.

Primary Factors causing the Transportation Problems

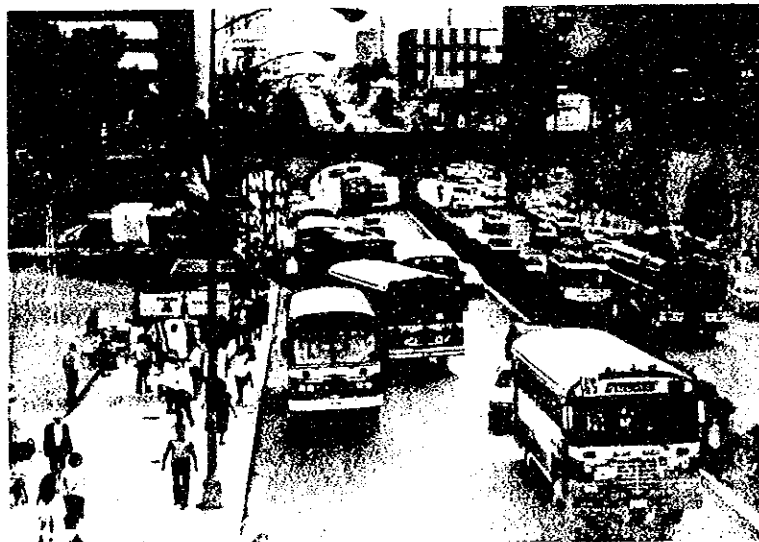
- 1) Urban Structure Factor
 - a) Concentration of Urban Activities to the City Center
 - b) Unorganized Residential Development
- 2) Road Network Configuration and Conditions Factor
 - a) Incomplete road network with many unlinked roads:
The topographic condition have produced many unlinked arteria which form cul-de-sac type roads.
 - b) Feeder road network for residential areas:
It is difficult to introduce arterial roads into such areas to connect with feeder roads there.
 - c) Insufficient capacity of arterial roads:
At present in areas where the traffic flow is concentrated, the traffic demand already exceeds the traffic capacity as the cross sectional traffic capacity and road number are insufficient.
- 3) The Public Transport Factor
 - a) Old and poor maintained bus
 - b) No clear distinction between function of buses and minibuses
 - c) Bus routes without overall integration
 - d) Lack of Bus Operation in Suburbs and at Night
 - e) Congestion in Buses in Peak Hours
 - f) Low Speeds of Buses in Peak Hours
 - g) Insufficient Bus Terminal and Facilities
 - h) Lack of Security in Buses
 - i) Cost Increase, Fare Increase and Burden of Subsidy
 - j) Insufficient Organizational Capability of Bus Companies
 - k) Need for Road Improvement of Bus Routes in Suburbs



Traffic Congestion



Low Quality Bus Service



Low Quality Bus Service

4. PERSON TRIP CHARACTERISTICS

Summary of Person Trips

(1) Total Number of Trips

The total numbers of person trips per day in 1990 in the Study Area were 3,423,142. Within those trips, 98.9% of them, 3,386,252 trips, are traveled by residents in the Study Area, while the remaining 36,889 trips are traveled by outside residents.

(2) Composition of Purpose

The composition of trip purpose was "to home" (47.7%), "to work" (22.5%) "to school" (14.6%), "others" (6.7%), "shopping" (4.5%), "business" (2.3%) and "to office" (1.5%).

(3) Composition of Mode

For the modal choice, bus (large bus system) was the highest as 35.9%, followed by passenger car (18.7%), microbus (17.1%) and walking (16.3%).

Trip Production Rate by Car Owning

The trip production rate was obviously different between the car owning household and the non-car owning household. The difference is about one trip according to the actual data. It is, therefore, clear that the availability of cars greatly effects the characteristics of trip production.

Trip Generation and Attraction

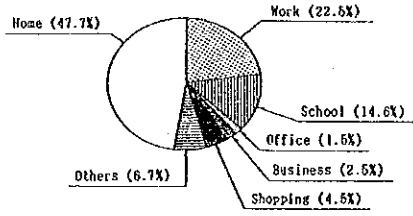
Both trip generation and attraction volume are large in zone 1, where is the business center, and residential areas, such as zone 7 and Mixco along CA-1, and zone 18 and Villa Nueva along CA-9. On the contrary, both trip generation and attraction volume are small in the Municipalities in south-eastern areas, such as Sta. Catarina Pinula, San José Pinula, Fraijanes, etc., where population is small.

Trip Distribution

As a peculiar point, very heavy OD trips can be seen between the western area, especially Mixco and Villa Nueva, and the central area of Guatemala City (zones 1 and 4). For the eastern area, particularly heavy trips generate in zone 18 and the relation to zone 1 is strong.

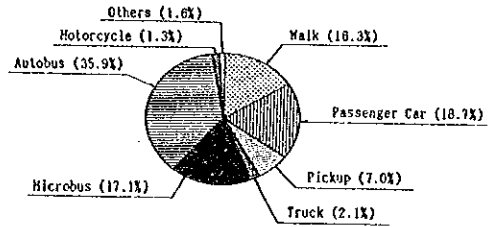
In Guatemala City, trips between zone 1 and its adjacent zones (zones 2 through 6), and between zone 4 and western areas (zones 7, 9, 11, 12 and 13) are heavy.

Trip Composition by Purpose
(All Mode)

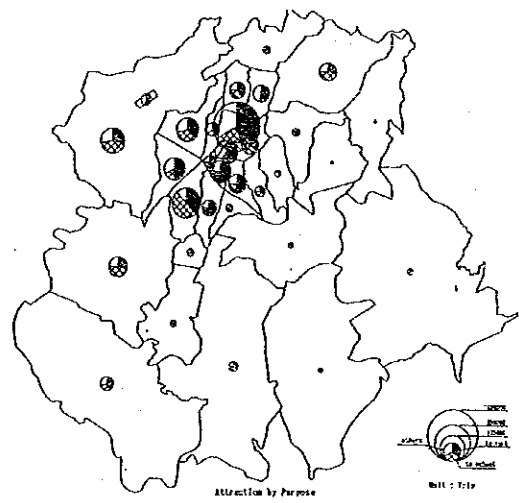
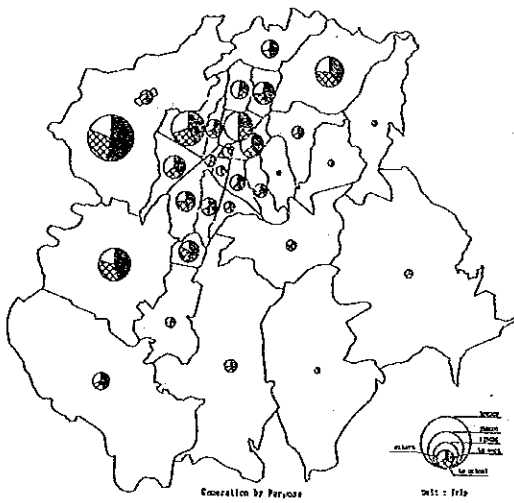


Composition of Trip Purpose

Trip Composition by Mode
(All Purpose)



Trip Composition by Mode



Trip Generation and Attraction by Trip Purpose



Desired Line of All Purposes

5. FUTURE URBAN DEVELOPMENT PATTERN

Socio-Economic Framework

Considering the recent indications toward recovery (the GDP growth rate for 1989 was 4% and is estimated at 3.5% for 1990) and the increase in economically active population, there will be a gradual increase in the growth of the national economy. Therefore it is anticipated that the growth rate of for the GRP of the Study Area will continue its increase from 4% in 1990 to 4.5% in 1995, and expand at an average annual growth rate of 4.5 % 1995.

The population of the Study Area was estimated to reach three million, 1.7 times of the current scale. The rate of population growth will gradually decline, but will still keep average 2.6% annual growth over the next two decades.

The number of persons employed in 2010 was estimated as 1.2 millions, almost two times of the present.

Urban Development Pattern

Since there is neither land use master plan nor land use regulation, the followings will occur;

- a) Various types of disordered development in western and southern area.
- b) Extending of low quality residential area without adequate urban infrastructure.
- c) Concentration of job opportunities in the Central District or along existing trunk road.
- d) Longer commuting distance and traffic congestion on radial roads.

To prevent such kind of problems, two pattern alternatives were proposed.

The Polycentric Pattern : to create several new development cores

The Corridor Pattern : to locate residential areas and working places along selected radial transport axes

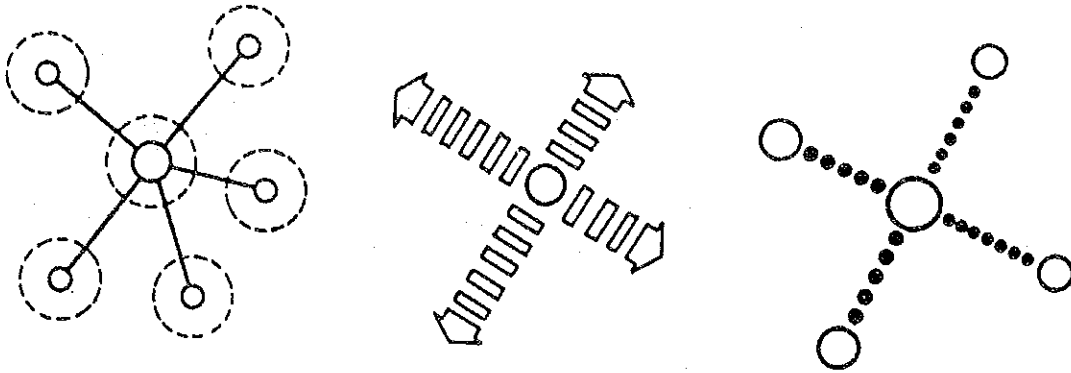
Comparing two alternatives, the Polycentric Pattern has advantages in transportation aspects, on the other hand, the Corridor Pattern has advantages in less expensive development and possibility of realization. Considering the elasticity of long future development and the recent urbanization trend, a medium type of two alternatives, the Corridor/Polycentric Pattern is proposed.

Land Use Plan

In the Study Area of 94 thousand hectares(ha) as a whole, the lands appropriate to urban use (less than 30% gradient) are estimated 46 thousand ha. In these habitable lands, 17 thousand ha have been urbanized, and lands of 8.5 thousand ha will be required as new development by 2010.

Population and Employment Distribution

The share of population of Central Guatemala and Mixco to the Study Area will decrease, but the other districts will increase. Also the share of employment of Central Guatemala will decrease.

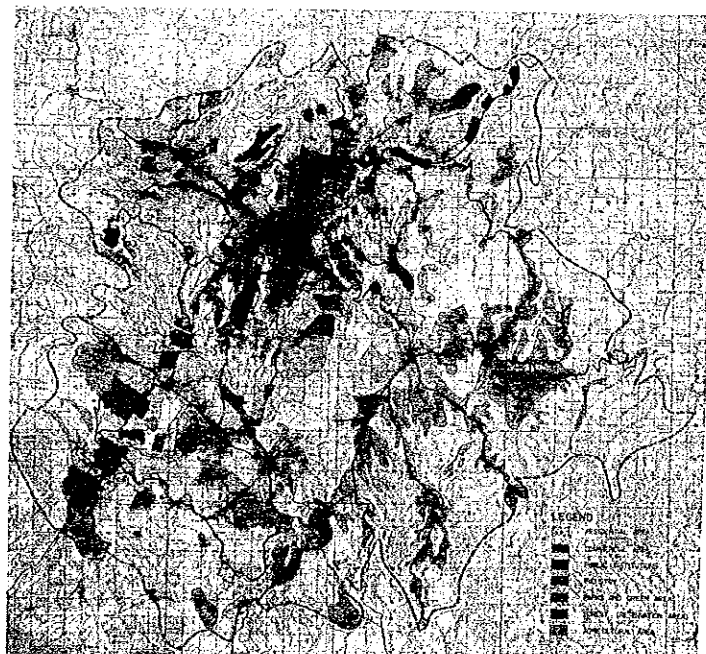


Future Urban Development Pattern

Change in Population and Employment Distribution, 1990-2010

Unit : 1,000 persons

Zone Group	Population			Employment		
	1990	2010	Increase	1990	2010	Increase
Central Guatemala	830.0 (46.1%)	936.0 (31.2%)	106.0 (8.8%)	484.6 (77.6%)	674.5 (56.1%)	189.9 (31.6%)
East Guatemala	225.0 (12.6%)	444.5 (14.8%)	219.5 (18.3%)	33.1 (5.3%)	111.1 (9.1%)	78.0 (13.0%)
Mixco	364.5 (20.2%)	691.0 (19.7%)	226.5 (18.9%)	47.1 (7.5%)	124.3 (10.1%)	77.2 (12.8%)
Villa Nueva	273.5 (15.2%)	539.5 (18.0%)	266.0 (22.2%)	42.7 (6.8%)	156.0 (12.7%)	113.3 (18.9%)
Petapa	55.0 (3.1%)	308.0 (10.3%)	253.0 (21.1%)	9.9 (1.6%)	62.1 (6.7%)	72.2 (12.0%)
Sta. Catarina Pinula	52.0 (2.9%)	181.0 (6.0%)	129.0 (10.7%)	7.6 (1.2%)	77.0 (6.3%)	69.4 (11.6%)
TOTAL	1,800.0 (100%)	3,000.0 (100%)	1,200.0 (100%)	625.0 (100%)	1,225.0 (100%)	600.0 (100%)



Future Land Use (2010)

6. FUTURE TRANSPORTATION DEMAND

Increase of Person Trips

The trip production traveled by car owners can be estimated as 3,296,500 (53.9%) person trips in 2010, and that of non-car owners is 2,819,600. The total of both trips is 6,116,100 that is 1.8 times of present number of person trips.

Estimated Car Ownership Growth

In the year 2010, the ratio of car owning household increases to 46.6%, while the number of household increases to 625,000. Besides, the number of vehicles can be estimated to be 2.6 times of the present figure. Therefore, passenger car traffic can be estimated to increase, and the increase must cause more traffic congestion.

Change of Person Trip Volume Generated and Attracted

The large volume of person trips will be generated in the central district in the Municipality of Guatemala, especially in zone 1. Increase of generation in suburban areas such as Mixco, Villa Nueva and zone 18, is obviously great as can be seen in the illustration.

Future OD Flow by Direction

The number of person trip between Central Guatemala and Mixco will be the largest, and that between East Guatemala and Central Guatemala will be next. The person trip flow from Sta. C. Pinula will be not so large. Therefore, it can be pointed out that there are four major trip axes of transit relating different parts of the Study Area.

Distribution of Trips by Purpose

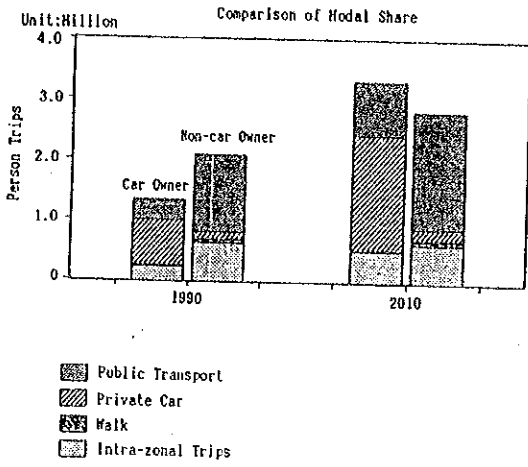
Many workers and students concentrate in the central area of Guatemala City coming from suburban areas such as Mixco and zone 18. However, the relation between Mixco and Villa Nueva, which are supposed to be large city cores outside Guatemala City, become stronger.

Assignment on "Do-nothing" Network

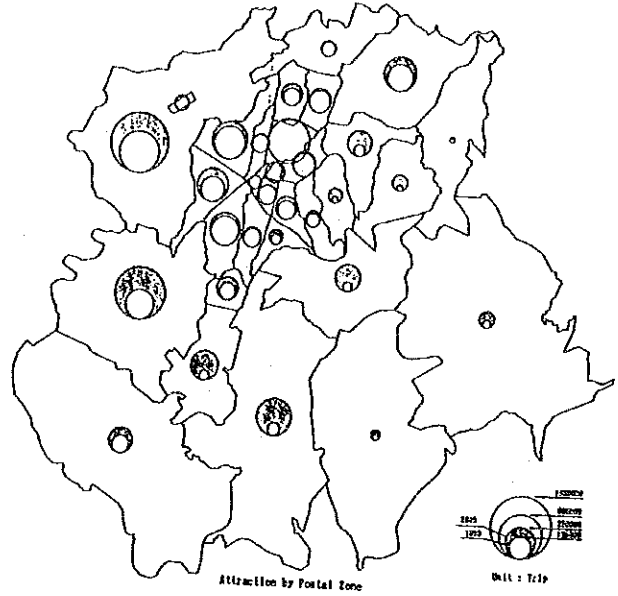
In order to evaluate the capacity of existing road network, future traffic volume was assigned onto existing transport network (Do-nothing network), resulting every arterial road should be congested by a massive volume of traffic.

In particular, terrible congestion will occur on the major roads such as CA9, CA1, and San Juan, and their traffic volume will exceed 150,000 PCU per day.

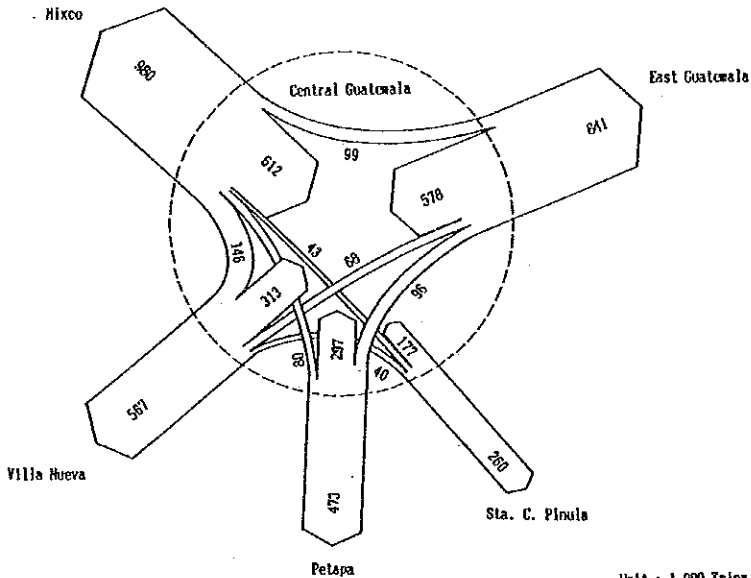
As the congestion rate of roads in CBD area will also higher than 1.0, much traffic will concentrate on Bolivar, 6a. Av. and 7a. Av.



Composition of Modal Share

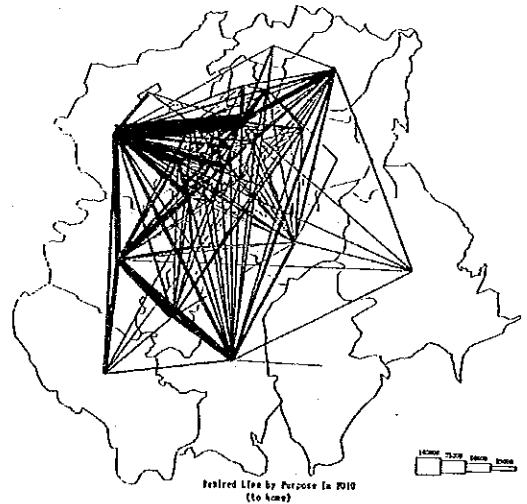


Growth of Trip Generation by Postal Zone



Principal Person Trip Flow

Unit: 1,000 Trips



Desired Line of "to home" Trip in 2010

7. TRANSPORTATION NETWORK PATTERN ALTERNATIVES

Objectives of the Master Plan

- a) Support the socio-economic development plan for the Guatemala Metropolitan Area.
- b) Secure fair access to transportation services for all citizens.
- c) Formulate a guideline for the transportation infrastructure and systems that will be formed in the long run.

Targets and Policies of the Plan

- a) The development of the transportation network shall be capable of growing as an integral part of the future urban land structure.
- b) Coping with the future transportation demand.
- c) Correcting the differences in the transportation services by area and society income level.
- d) The securing of the citizens safety and maintenance of good environment.
- e) Effectiveness with reasonable investment.

Under the above planning targets, the following planning policies were identified.

- a) To emphasize a public transport network
- b) To maintain an adequate transportation service level

Alternative Plans on the Basis of Transport Network

The following transport systems are prepared for alternative plans, based on their transport network.

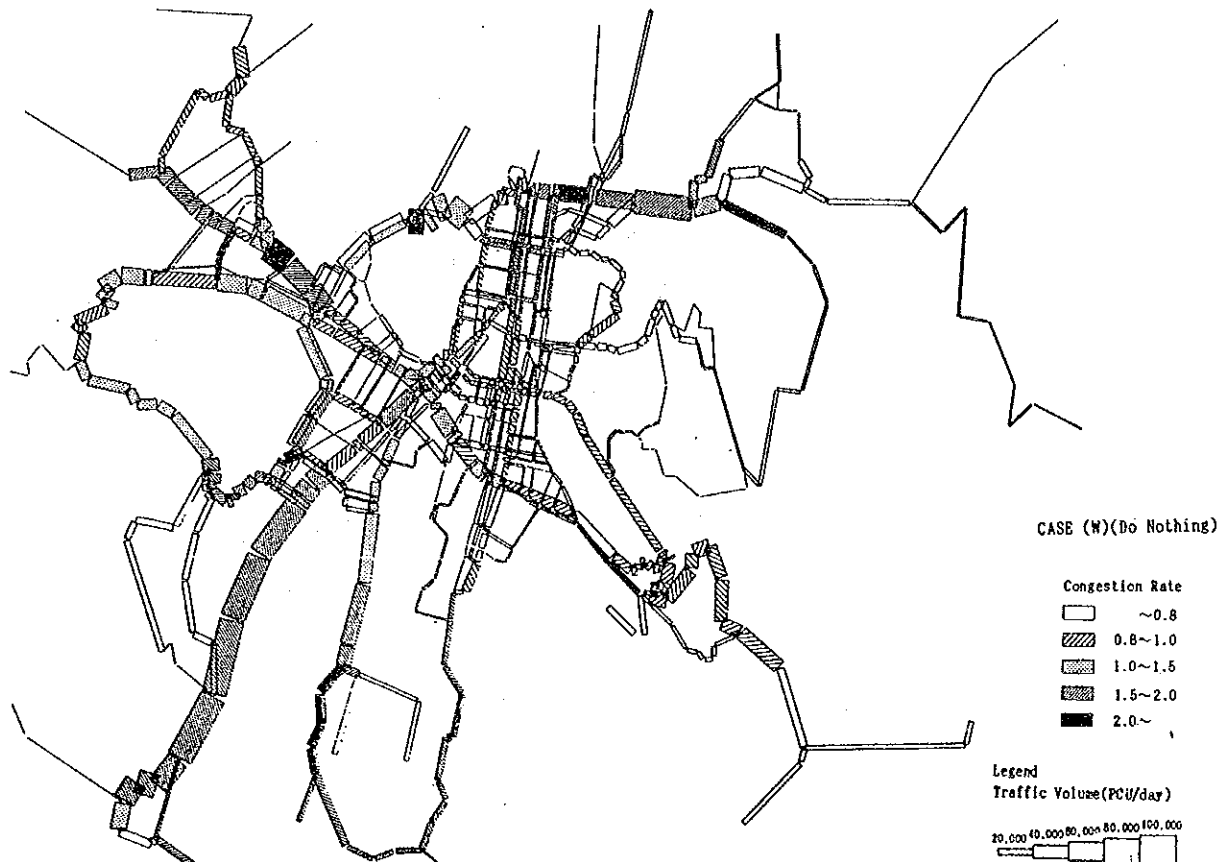
- 1) Strengthening of public transport system
 - a) To introduce bus exclusive lane system
 - b) To introduce busway system
 - c) To introduce railway system
- 2) Improvement of road network system
 - a) To strengthen radial network system
 - b) To strengthen radial and ring road network system

The six alternative plans are prepared as a combination of the above-mentioned systems.

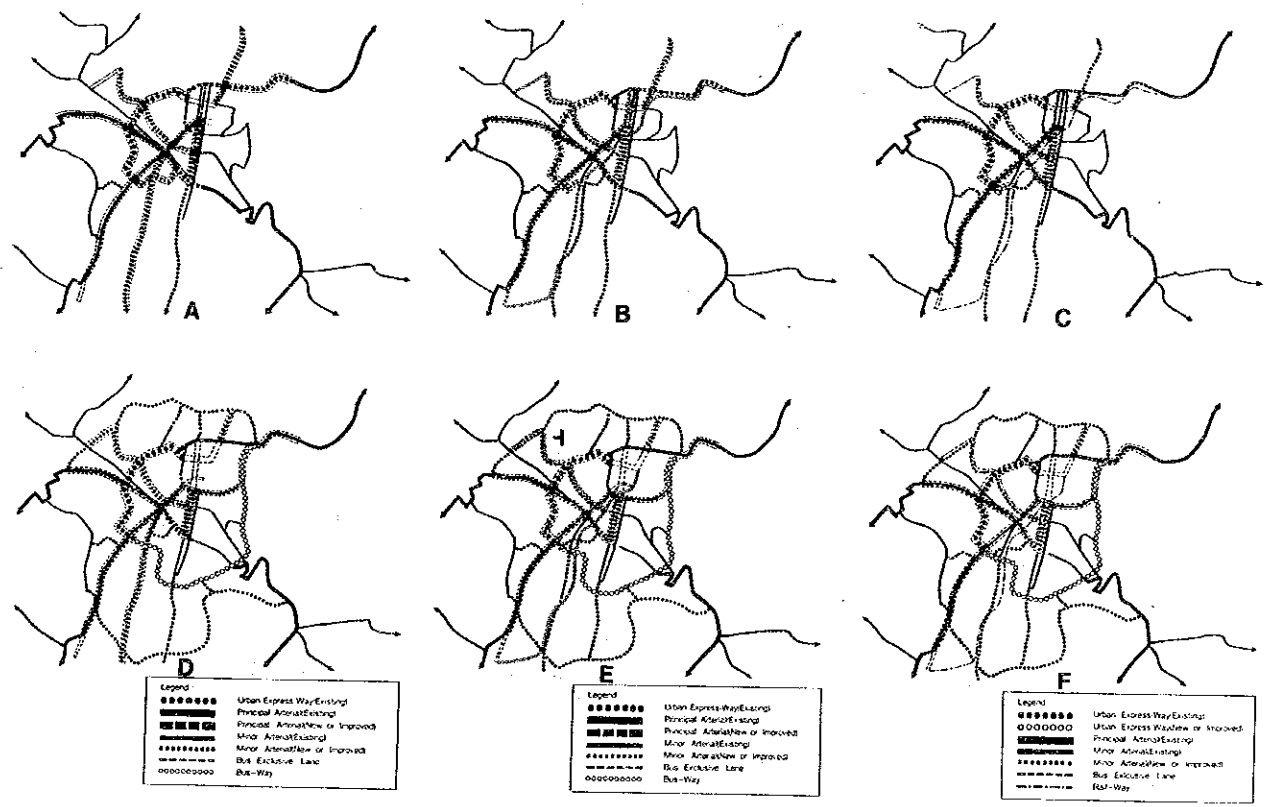
Evaluation of Alternative Plans

Based on the results of a comparison study for selecting the most viable transport network plan, Alternative Plan E is selected. The main reasons are as follows:

- a) All six alternative plans are technically and economically feasible. The Alternative Plans can be implemented.
- b) However as a result of economic evaluation, Alternative Plan E showed the highest economic indicator value among the six Alternative Plans.
- c) Considering the future traffic congestions, the future study on introducing a railway system will be required as a long term public transportation plan.



Traffic Condition on Do Nothing Case



Alternative Plans

8. TRANSPORTATION MASTER PLAN

Basic Transport Networks

Considering the future transport conditions, basic planning policies of the selected Alternative Plan-E are identified as follows.

- a) The strengthening of public transport system is adopted as the first priority of transport planning policy.
- b) The improvement road network system is adopted as secondary priority of transport planning policy.
- c) The traffic management system is placed as easy implementation scheme.

(1) Road Network Plan

- a) Development of inner ring road (24- Calle)
- b) Development of middle ring road (Periferico)
- c) Development of outer ring road
- d) Development of radial roads on east-west and north-south transport axes.
- e) Improvement of various intersections.

(2) Public Transport Plan

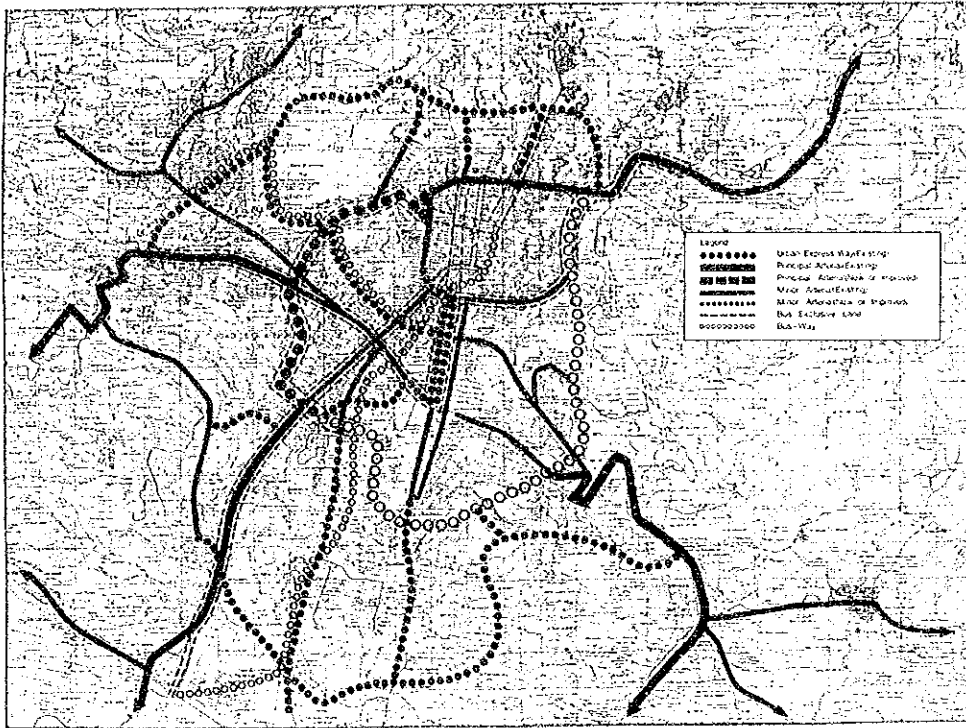
- a) Introduction busway on east-west and north-south transport axes.
- b) Introduction of bus exclusive lane on major roads.
- c) Improvement of bus facilities (bus bay, terminal).
- d) Improvement of bus operation system.

(3) Traffic Management Plan

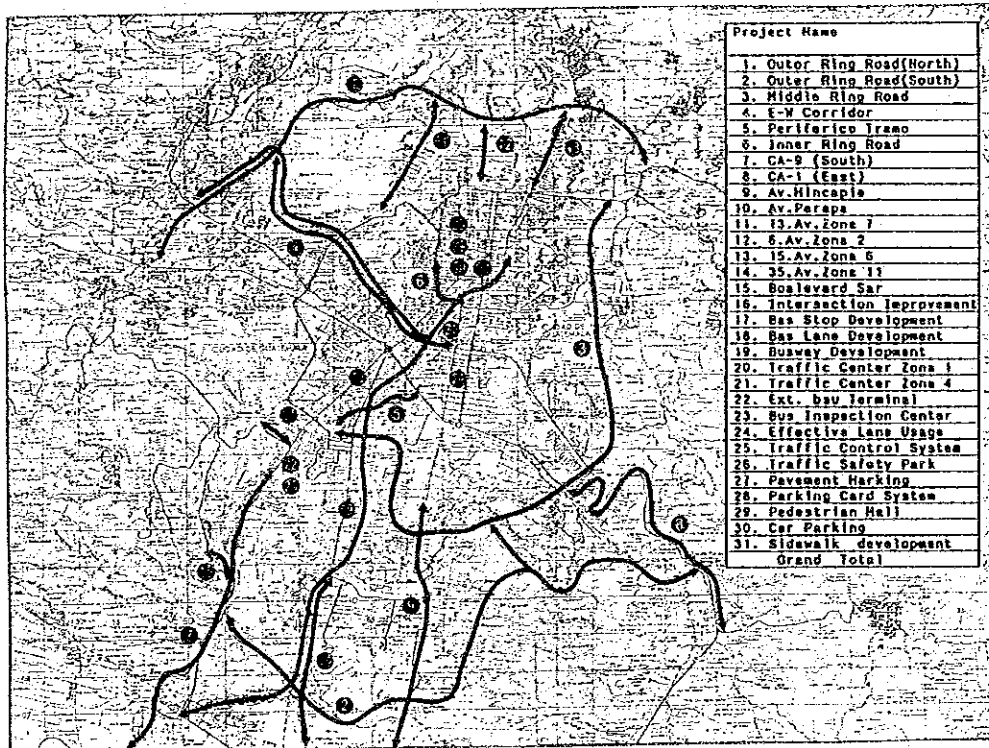
- a) Improvement of traffic signals on urban area.
- b) Development of traffic safety facilities.
- c) Improvement of car parking facilities and systems.

The following items are expected to improve the urban activities in the Study Area according to the implementation of transport master plan.

- a) To mitigate the traffic congestion.
- b) To ensure traffic safety and smooth traffic flow.
- c) To increase travel speed.
- d) To maintain good urban environment.
- e) To keep economy transport energy.



Transportation Master Plan Network - Alternative Plan E



Location of Projects on Master Plan

9. ROAD PLAN

Road planning is conducted based on the selected transport network alternative, that is strengthening of radial and ring road network.

Basic Consideration for Planning

Road facilities planning is executed for solution of the urban and suburban transport problems and also to contribute to the national economic activities in keeping good traffic environmental conditions. The subjects to be solved in urban transportation problems are fundamentally following four items.

- a) To solve the traffic congestion
- b) To ensure the traffic safety
- c) To maintain a good traffic environment
- d) To save traffic energy

Design Criteria

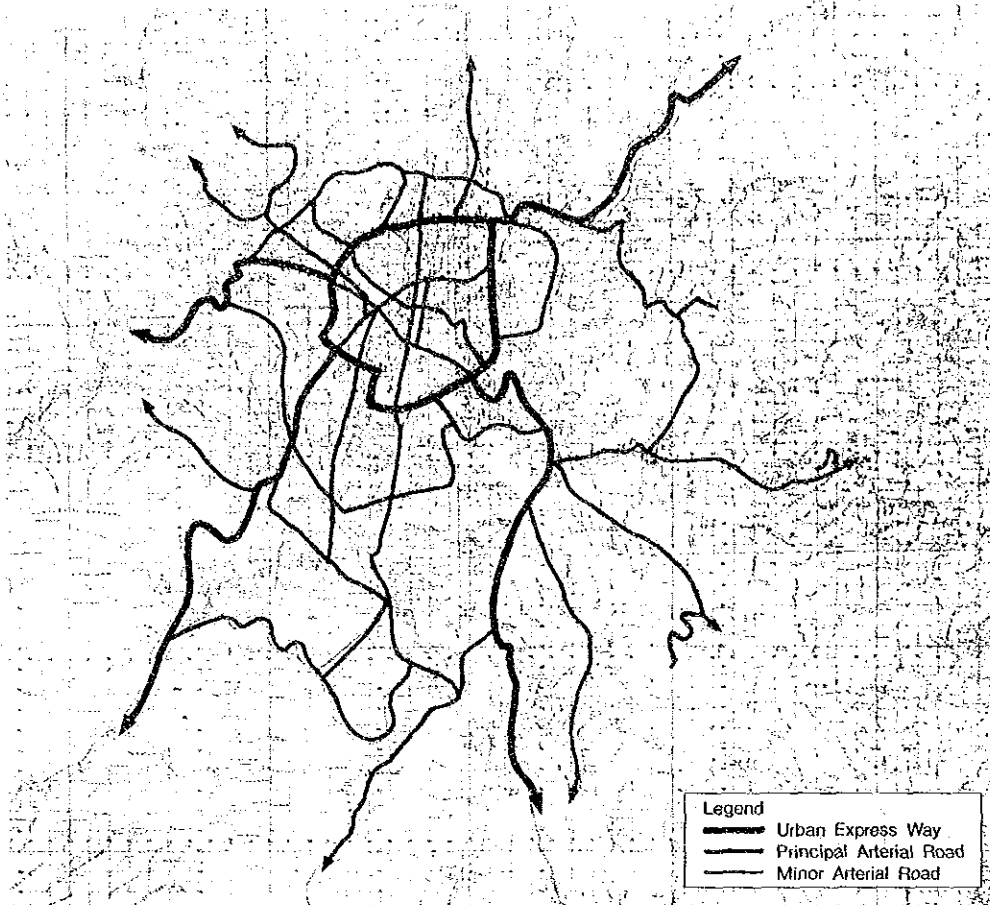
Based on the following planning premises of design criteria, the road planning is conducted.

- a) The road planning is carried out on trunk roads, that is, Urban Express Way, Principal and Minor Arterial roads.
- b) The planning target year is adopted to be year 2010.
- c) American Road Design Standards are adopted for design elements.
- d) Preliminary design is carried out to use the map of a scale of 1/15,000 and 1/5,000.

Planned Road in the Study

Mayor road projects with relatively large scale investment are as follows:

- Outer Ring Road (North)
- Outer Ring Road (South)
- Middle Ring Road
- East-West Corridor
- Inner Ring Road
- CA-9
- CA-1
- Ave. Hincapie
- Ave. Petapa
- Intersection Improvement



Future Road Network Configuration

Planned Road Projects and Lane Number

Name of Plans	Planned Length (m)	Future (2010) Traffic Volume (pcu/day)	Capacity for one lane (1 st lane) (pcu/h)	Number of lanes required
1. New Road Const. Plan	75,200	----	----	----
1-1 Middle Ring Road (Periférico)	20,400	40,000 73,000	19,000	4
1-2 Outer Ring Road (North)	16,700	10,000 35,000	(10,000) 12,500	2 or 4
1-3 Outer Ring Road (South)	23,150	10,000 20,000	(10,000) 17,500	2 or 4
1-4 East-West Corridor	11,540	30,000 45,000	12,500	4
1-5 Periférico Tramo (3a,3b)	3,500	49,000	12,500	4
2. Road Improvement Plan	43,040	----	----	----
2-1 Inner Ring Road (24 Calle)	1,560	27,000	12,000	2 to 4
2-2 Avenida Tatapa	6,000	58,000	12,500	2 to 4
2-3 Avenida Hincepié	10,000	52,000	12,500	2 to 4
2-4 13 Avenida zona 7	2,050	34,000	12,000	2 to 4
2-5 6 Avenida zona 2	1,120	28,000	12,000	2 to 4
2-6 15 Avenida zona 15	1,300	27,000	12,000	2 to 4
2-7 35 Calle zona 11	1,090	91,000	12,000	2 to 6
2-8 Blvd. Sur Zona 11	1,400	44,000	12,000	2 to 4
2-9 CA-9 (South)	7,000	72,000	12,500	4 to 6
2-10 CA-1 (East)	10,500	75,000	12,500	4 to 6
Total	118,330			

10. PUBLIC TRANSPORT PLAN

Reorganization of Bus System to Hierarchical Structure

Increase of capacity and speeds without causing inefficiency or road congestion by introducing :

- a) Extra-urban buses for non-commuter inter-regional trips
- b) Key route buses of large capacity connecting major OD pairs along major radial roads
- c) Ordinary buses of medium capacity connecting minor OD pairs along local roads
- d) Feeder buses of small capacity for branch routes of key route buses and for inside CBD

To meet the public transport demand in 2010, renewal of the existing fleet and approximately 800 new buses are necessary.

Busways and Bus Lanes for Skeleton of Public Transport

Busways (roads only for buses) connect the two large population centers with CBD. Bus Lanes are along arterial routes with 3 lanes each way and are used exclusively by buses during peak hours.

Development of Bus Centers and Terminals

Efficient operation of the bus system is supported by:

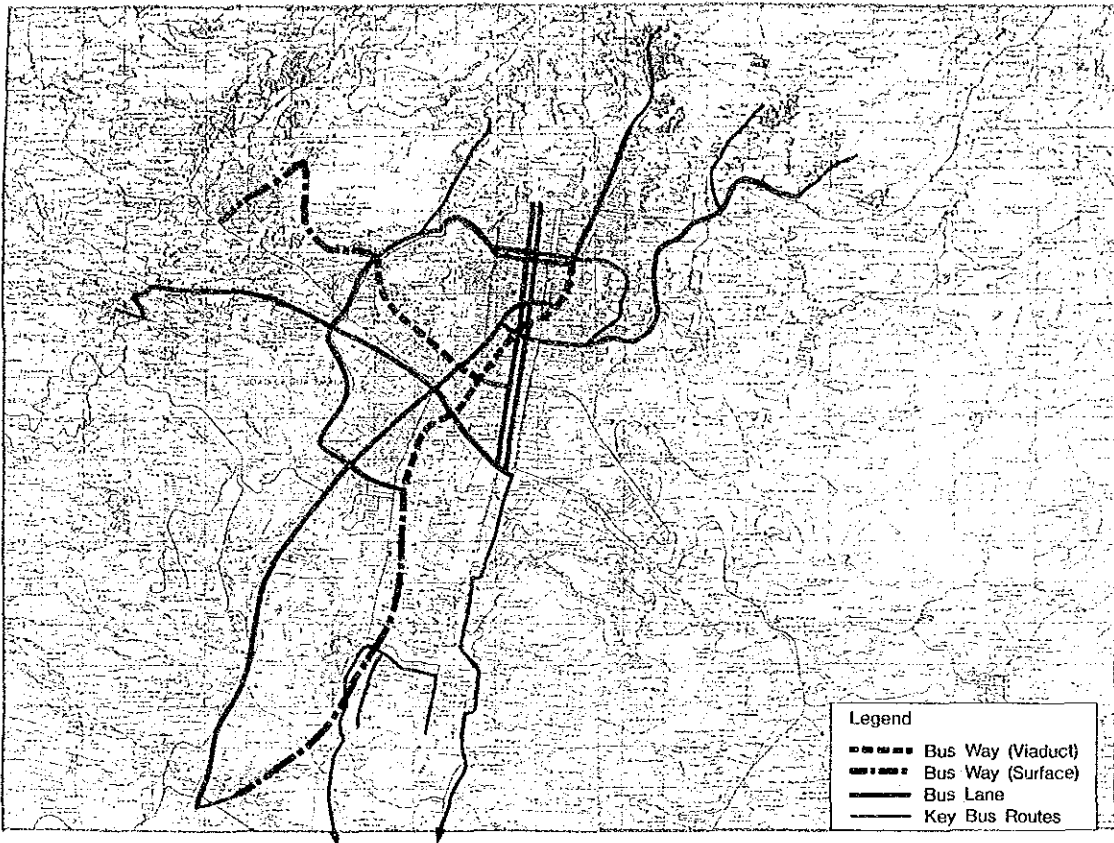
- a) Zona 1 and Zona 4 Bus Centers
- b) West, South and North Extra-urban Bus Terminals
- c) Bus Inspection and Maintenance Center
- d) Improvement of Bus Stops

Revision of Subsidy System

Revision of existing subsidy system (subsidy to transport operators) is necessary. When subsidy system is changed, it should be considered to prevent the low income class difficulty to access urban transport, and to secure the conversion of subsidy to the urban transport development fund.

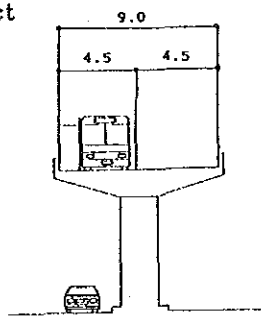
Conversion from Busways to Rail Transit System

The busways should be designed so as to be converted to a rail transit system when the situation is changed in favor of rail transit.

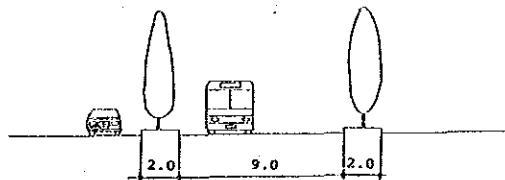


Busway and Bus Lane Network

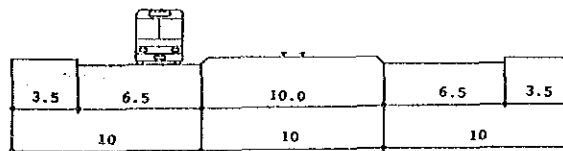
Case 1 Viaduct



Case 2 Surface



Case 3 FEGUA's Right of Way



Typical Cross Sections of Busways

11. TRAFFIC MANAGEMENT PLAN

Planning Aims

Traffic management improvement plans can be carried out with relatively small investments on existing transport infrastructure and also, trials and experimentations are possible in traffic management, providing opportunities for alterations based on monitored changes in traffic flow. Traffic management system should be updated yearly in response to the most recent changes.

The planning policies in the urban area and the Centro area are identified as follows.

1) Urban Area

- a) To increase traffic capacity.
- b) To control traffic follow and volume.
- c) To decrease traffic accidents.

2) Centro Area

- a) To create and improve the pedestrian environment.
- b) To from the pedestrian network.
- c) To ensure smooth and convenient and adequate parking.

Projects on Traffic Management Plan

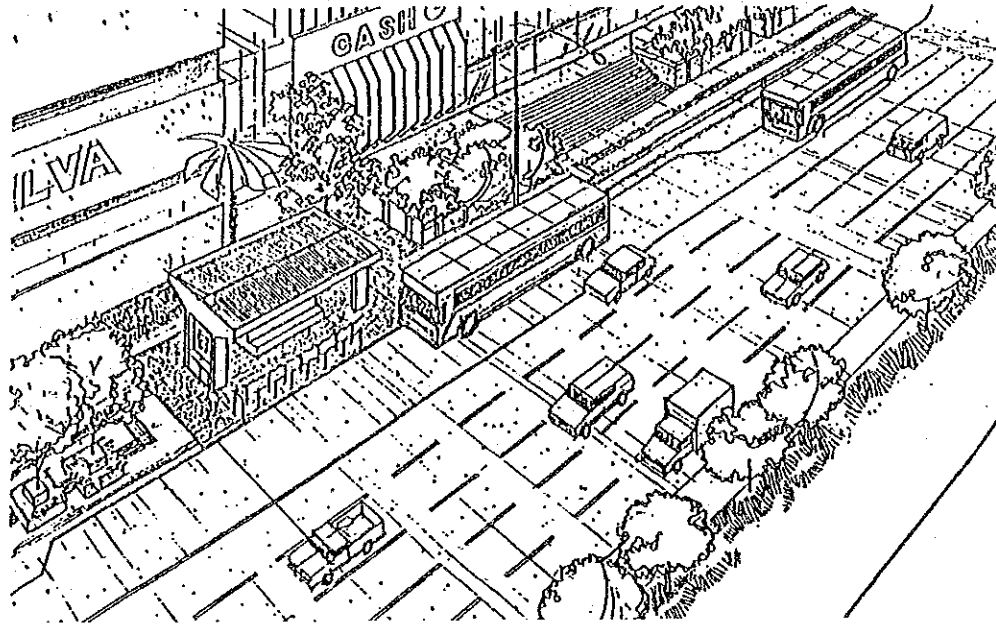
Based on the policies and traffic characteristics and conditions, following projects are planning identified for traffic management plan.

1) Urban Area

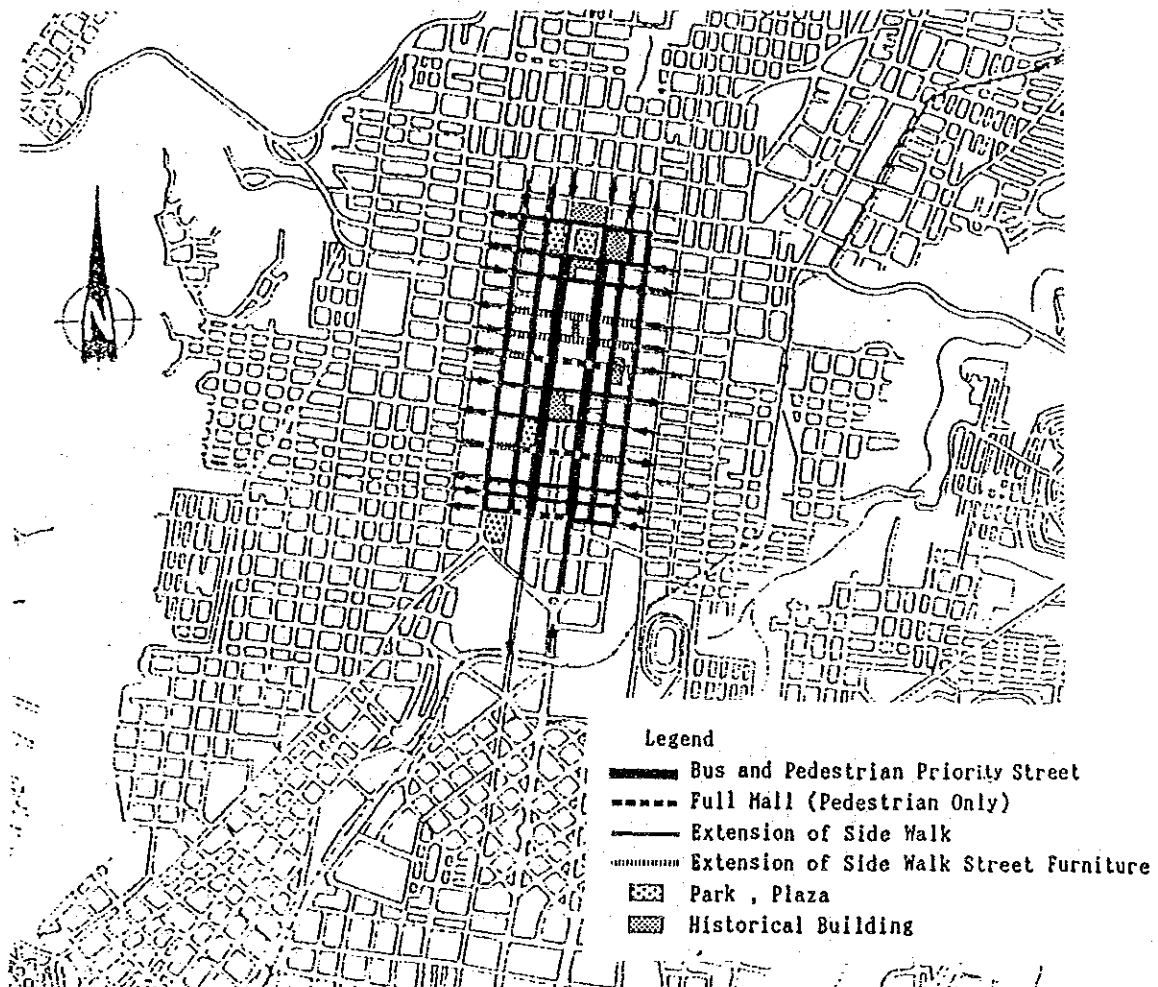
- a) Effective lane usage project (6a,7a Avenida)
- b) Improvement traffic control system project
- c) Development traffic safety park project
- d) Improvement of pavement marking project

2) Centro Area

- a) Improvement of parking card system project
- b) Development of pedestrian mall project
- c) Development of car parking project
- d) Development of side walk project



Perspective of Effective Lane Usage Project



Projects Location of Centro Area

12. IMPLEMENTATION PLAN

Implementation Schedule

(1) Phasing Plan

The following phasing plans are identified considering the function and characteristics of the projects.

- a) Phase - I : 1992 - 1993 Immediate Action Project
- b) Phase - II : 1992 - 1995 Short Term Project
- c) Phase - III : 1996 - 1999 Mid Term Project
- d) Phase - IV : 2000 - 2010 Long Term Project

(2) Implementation Schedule is decided as shown in "Figure Implementation Schedule and Investment" considering the following basic policies.

- 1) Immediate Action Project (1992 - 1993)
 - a) High efficiency project.
 - b) Small size construction project.
 - c) Without additional land acquisition project.
- 2) Short Term Project (1992 - 1995)
 - a) High efficiency project.
 - b) Comparatively small size construction project.
 - c) Development East-West and North-South transport axes project.
- 3) Mid and Long Term Project (1996 - 2010)
 - a) Harmonization of future traffic demand.
 - b) Formulation of future road network.
 - c) Combination of the future transport system.

Investment Schedule

The total investment is estimated as about 2,387 million Quetzales in 1991 price. The investment of Urgent/Short Term, Mid Term and Long Term Projects are estimated as 394,990; 508,560; 1,483,627 thousand Quetzales respectively.

Financial Subjects




The following conditions can be considered to procure the funds for implementation of the transport master plan.

- a) Implementation of city planning tax.
- b) Introduction of development tax.
- c) Fund converted from bus subsidy.
- d) Increases of automobile fuel surcharge tax.
- e) Introduction of automobile tonnage tax.
- f) Introduction of the toll system. (Revenue from toll busway)
- g) Increase of road budget by Guatemala Government.
- h) Procurement of foreign loan.

Implementation Schedule and Investment

Unit(Q 1000)

Project Name	Project Cost	1 9 9 0		2 0 0 0	
		92	95	00	05
1 Outer Ring Road(North)	287,525				
2 Outer Ring Road(South)	163,339				
3 Middle Ring Road	469,999				
4 East-West Corridor	151,399				
5 Periferico Toramo	25,519				
6 Inner Ring Road	81,029				
7 CA-9 (South)	61,048				
8 CA-1 (East)	84,743				
9 Ave.Hincapie	124,670				
10 Ave.Petapa	59,361				
11 13 Ave. Zona 7	2,642				
12 69 Ave. Zona 2	17,001				
13 15 Ave. Zona 6	16,514				
14 35 Ave. Zona 11	35,784				
15 Boulevard Sur	11,729				
16 Intersection Improve	105,817				
17 Bus Stop Development	3,306				
18 Bus Lane Development	3,794				
19 Busway Development	493,950				
20 Bus Center Zona 1	9,620				
21 Bus center Zona 4	12,000				
22 Extraurban Bus Term.	42,842				
23 Bus Inspection Center	21,700				
24 Effective Lane Usage	4,841				
25 Traffic Control System	11,301				
26 Traffic Safety Park	5,940				
27 Pavement Marking	1,548				
28 Parking Card System	500				
29 Pedestrian Mall	2,843				
30 Car Parking	72,200				
31 Sidewalk Development	2,673				
Total	2,387,177	394,990	508,560	1,483,627	

 Short Term Projects
 Middle Term Projects
 Long Term Projects

13. EFFECTS OF MASTER PLAN

Basic Concept of Evaluation

The goal of the master plan is to establish an integrated program to provide and improve public facilities in order to smooth urban activities and to maintain a healthy living standard for the citizens. The recommended projects are selected through comprehensive engineering, economic and environmental examination on the basis of the above purpose.

Evaluation Indicators

1) Engineering Aspect

Traffic conditions are significantly improved not only by constructing roads but also by improving traffic management system and public transportation system.

In particular, the average congestion level decreases to 0.98 in 2010, compared with 1.56 for the "Do Nothing Case in 2010".

2) Economic Aspect

The Proposed project package shows a high IRR of 45.5%. Judging from the interest rate (26% from the domestic bank and 12% from international lending agencies such as the World Bank), the proposed project package is considered highly feasible.

3) Social Impact

As other socio economic benefits, increases in GDP, employment of unskilled labors and saving in gasoline and diesel consumption are calculated.

In addition, these effects can spread to other economic fields. Development effects can be considerably expected after the projects are completed.

Concerning environment aspect, air pollution, noise level and traffic accidents will be reduced through the improvement of traffic conditions.

Value of Evaluation Indicators

1. Traffic Aspects		
1-1	Vehicle Travel Distance (1,000 Veh. Km)	13,848
1-2	Vehicle Travel Time (1,000 Veh. b)	806
1-3	Average Travel Speed (Km/hour)	24.8
1-4	Average Congestion Degree	0.98
2. Economic Aspects		
2-1	Total Benefits (Million Q.)	58,502
2-2	Project Cost (Million Q.)	2,502
2-3	IRR (%)	45.5
2-4	B/C	3.400
2-5	N.P.V (Million)	2,791
3. Social Aspects		
3-1	GDP Increment (Million Q.)	6,580
3-2	Unskilled Employment (person/year)	23,100
3-3	Fuel Saving	
	Gasoline (1,000 Liter/year)	856.5
	Diesel (1,000 Liter/year)	855.3

Economic Indicators by Project Term

Project Term	IRR (%)	B/C	NPV (Q. Million)
1992-1995	59.7	5.081	1051
1992-2000	46.3	3.499	1781
1992-2005	45.9	3.855	2767
1992-2010	45.5	3.400	2791

14. RECOMMENDATIONS

Necessity for Realization of the Master Plan

The total number of generated trips in the Study Area will increase by 1.8 times the 1990's scale by 2010. To meet the future transportation demand, the transportation network should be expanded according to the schedule recommendations.

All projects in the Master Plan are economically and technically feasible. Therefore, the only one thing to be done is to seek the measures to realize the Master Plan.

Financial Resources

Public facilities and infrastructure projects provide specific benefits to certain beneficiaries. Therefore, it is strongly recommended that the necessary funds be collected according to the amount and direction of the benefits as much as possible. The financial program is planned on the basis of this principle, that is, beneficiary charge.

The financial sources are as follows;

- City Planning Tax, Development Tax
- Conversion from Bus Subsidy Fund
- Automobile Fuel Surcharge Tax, Automobile Tonnage Tax
- Revenue from Toll Busway
- Increase of Road Budget
- Foreign Loan

Institutional Reforms

To secure the financial resources of the Master Plan, it is necessary to create a separate revenue collecting system exclusively for urban transport infrastructure development.

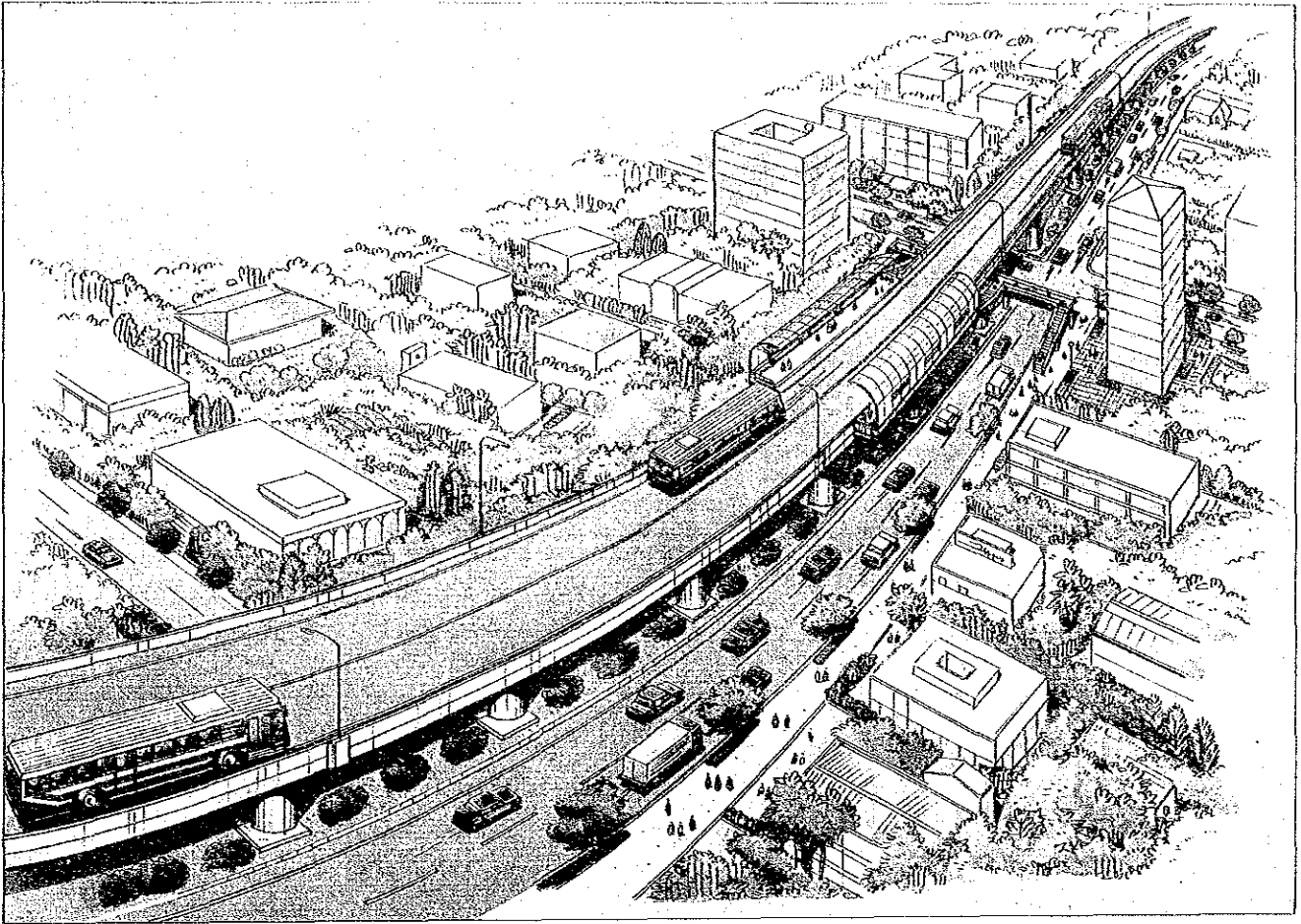
Since Guatemala lack an organization to coordinate among the various official agencies related to urban transportation in GMA, it is also necessary to create a organization, such as Guatemala Metropolitan Transport Commission, representing local governments, the central government and the private sector.

Further Studies

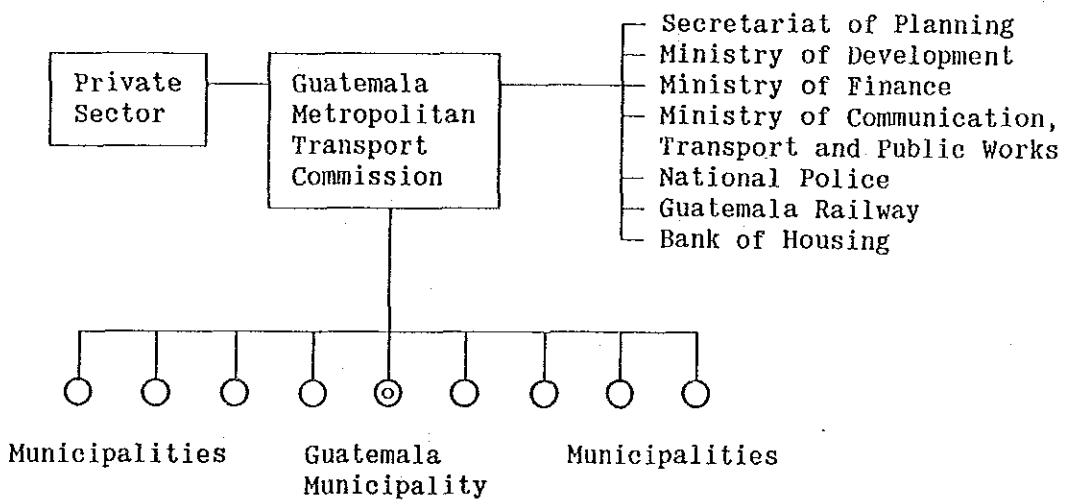
For the Master Plan advance, further studies are required as the next stage.

- a) Feasibility study on large scale short and mid term projects such as development of roads and public transport axis in the direction of East/West and North/South.
- b) Feasibility study or detailed study on small scale projects such as interchange improvement or traffic control.
- c) Bus operating rationalization study on bus rerouting, bus maintenance and bus management database etc..

Furthermore, an integrated urban development study is essential to harmonize with urban transportation development and land use or other sectors.



Perspective of Recommended Busway (Viaduct)



Organization Chart of Metropolitan Transport Commission

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 Road Planner (Deputy Manager)
 Transportation Planner
 Public Transportation Planner
 Demand Forecast Analyst
 Transportation Survey Analyst
 Transportation Survey Supervisor
 Land Use/Urban Development Planner
 Street and Parking Planner
 Traffic Planner
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