 NAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

METRO MANILA URBAN EXPRESSWAY SYSTEM STUDY

FINAL REPORT

VOLUME I

EXECUTIVE SUMMARY

OCTOBER 1993

KATAHIRA & ENGINEERS INTERNATIONAL

Exchange Rate		
Master Plan	March, 1992	1 ₱ 5.00 Yen, 1 US$ = 25.50 Pesos
Feasibility Study	April, 1993	1 ₱ 4.50 Yen, 1 US$ = 25.50 Pesos

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

METRO MANILA URBAN EXPRESSWAY SYSTEM STUDY

FINAL REPORT

VOLUME I

EXECUTIVE SUMMARY

OCTOBER 1993

KATAHIRA & ENGINEERS INTERNATIONAL

PREFACE

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct a master plan and feasibility study on Metro Manila Urban Expressway System and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines a study team headed by Mr. Tsuneo Bekki, Katahira & Engineers International, three times between March 1992 and August 1993.

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

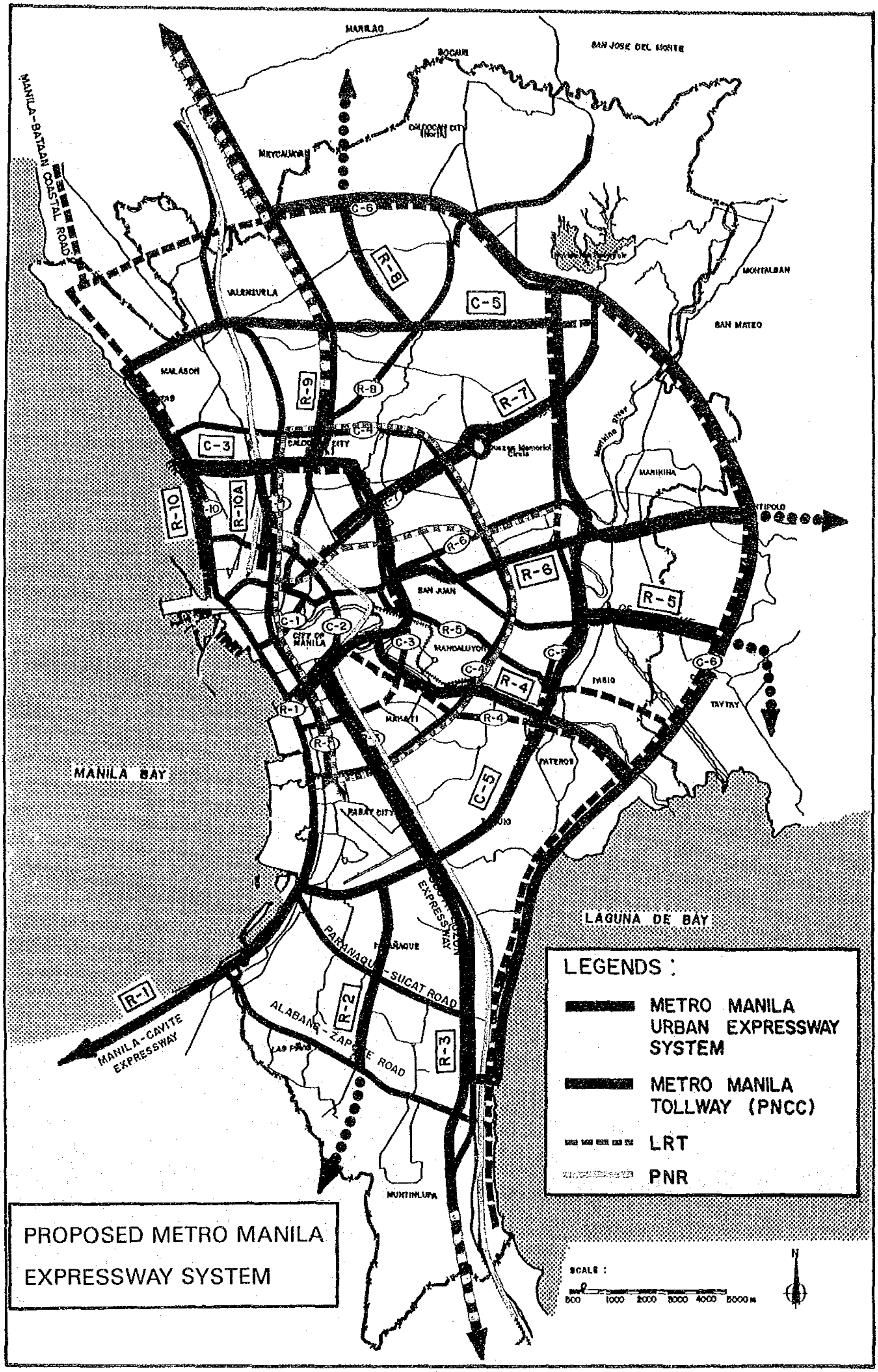
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between the two countries.

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

October, 1993

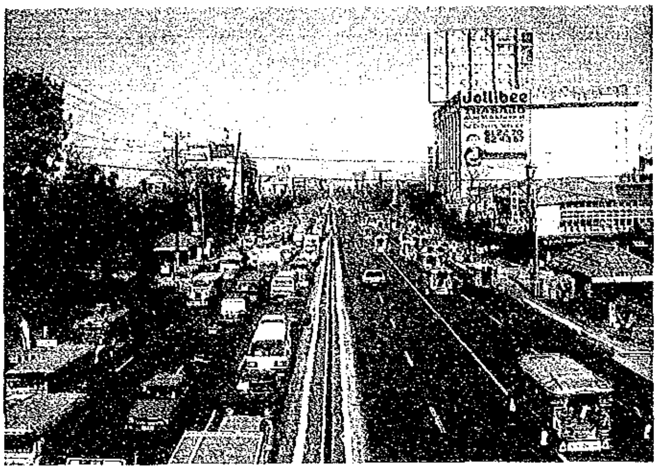
Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency



PROPOSED METRO MANILA EXPRESSWAY SYSTEM

EDSA (C-4)



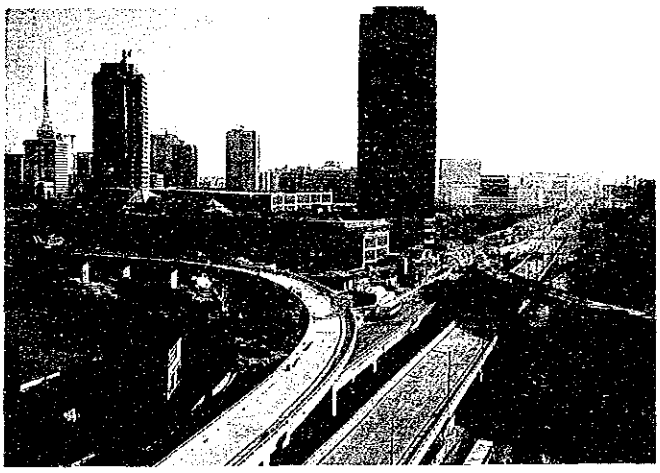
QUEZON AVENUE (R-7)

TAFT AVENUE (R-2)

ROXAS BOULEVARD (R-1)

TRAFFIC CONDITION ON METRO MANILA ROADS

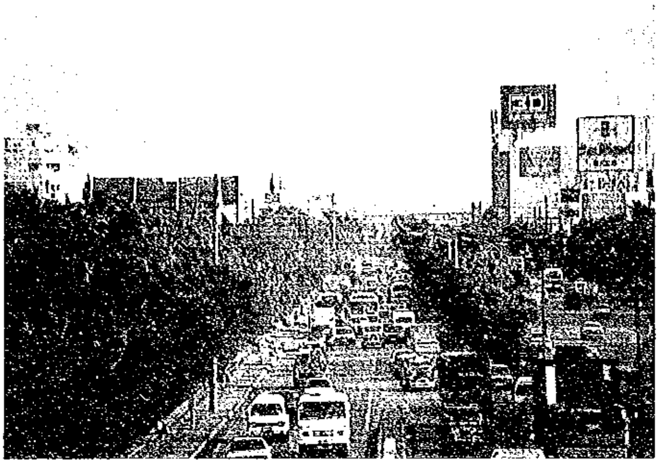
MAKATI CBD



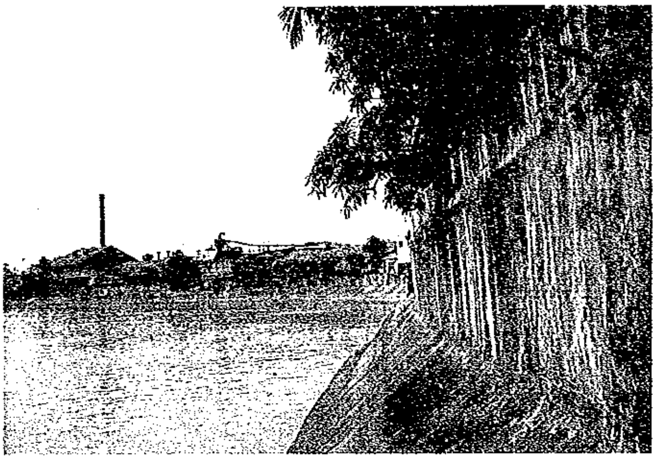
ORTIGAS CBD

GROWING CBDs

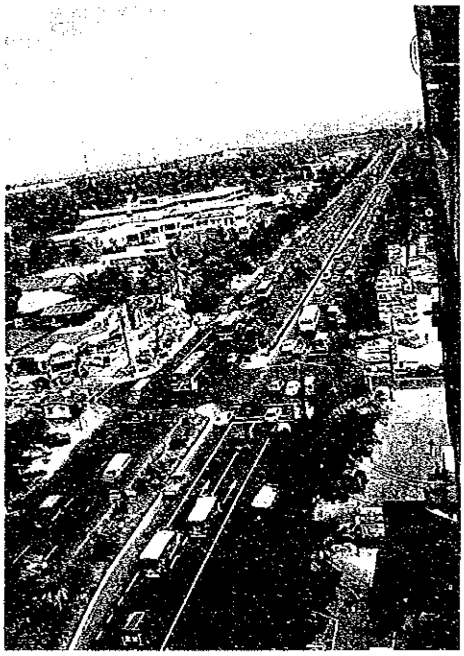
At-grade C-3 (Araneta Avenue) over which Inner Circumferential Expressway (EXPRESSWAY ROUTE C-3) will be constructed.



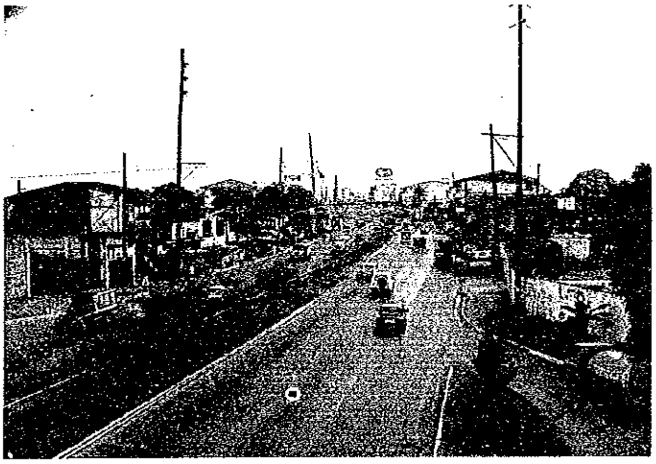
South Super Highway over which EXPRESSWAY ROUTE R-3 will be constructed.



Pasig River along which EXPRESSWAY ROUTE R-4 will be constructed.



Quezon Avenue over which EXPRESSWAY ROUTE R-7 will be constructed.



A. Bonifacio Avenue over which EXPRESSWAY ROUTE R-9 will be constructed.

At-grade R-10 over which EXPRESSWAY ROUTE R-10 will be constructed.

EXISTING CONDITION OF FIRST STAGE EXPRESSWAY ROUTES

SUMMARY

METRO MANILA URBAN EXPRESSWAY SYSTEM STUDY

A. MASTER PLAN FOR METRO MANILA URBAN EXPRESSWAY SYSTEM (MMUES)

1. BACKGROUND AND NEEDS OF URBAN EXPRESSWAYS

Metro Manila is growing rapidly with its concentration of people and economic activities. The present population of 7.9 million in 1990 will reach up to 11.4 million by year 2010 and transport demand, 97% of which depend on road transport, will increase from 13.6 million in 1990 to 21.6 million person trips a day in 2010. Transport condition will be progressively aggravated and an average travel speed on Metro Manila roads is estimated to decrease from 26 km/hour in 1990 to 16 km/hour in 2010, even though on-going and planned road projects are completed. Annual economic loss will be estimated at about 11.5 billion pesos if MMUES will not be realized.

At-grade road development in Metro Manila is getting increasingly difficult due mainly to road right-of-way acquisition and dislocation of affected people, thus the development of an elevated urban expressway system fully utilizing existing road right-of-way and other public lands is an effective measure and is urgently needed not only to reduce traffic congestion but also to improve the hierarchy of the urban transport system.

The master plan for Metro Manila Urban Expressway System (target year 2010) was formulated to systematically develop the urban expressway system.

2. OBJECTIVES OF MMUES

- To provide alternate transport facilities with higher service level
- To develop an efficient urban system
- To encourage the improvement of urban environment and amenities

3. METRO MANILA URBAN EXPRESSWAY SYSTEM

The configuration of MMUES is basically a circumferential and radial pattern in which two north-south transport axes are formed.

MMUES consists of two circumferential expressways (about 63 kms.) and 11 radial expressways (about 87 kms.) with a total extension of about 150 kms. The inner circumferential expressway is located at about 5 kms. in radius and the outer circumferential expressway at about 11 kms. in radius, both of which are linked with six radial expressways at an interval of 4 to 8 kms., thus an area of about 6 kms. x 6 kms. is surrounded by expressways. Three radial expressways extends towards Manila CBD from the inner circumferential expressway and eight radials towards outer areas of Metro Manila from the outer circumferential expressway.

Circumferential and radial expressways are connected with each other by 17 interchanges and access to at-grade roads are made by 61 each of on- and off-ramps.

4. STAGE DEVELOPMENT

MMUES will be developed in three stages as follows:

First Stage (60 km) : the inner core expressways and those which attract high expressway users are constructed in this stage.

Second Stage (66 km) : the expressways which serve for rapidly urbanizing areas are built in this stage.

Third Stage (24 km) : the remaining expressways of MMUES are completed in this stage.

5. EXPRESSWAY TRAFFIC

Expressway patronage is greatly affected by (1) expressway user's time value, (2) traffic congestion level of at-grade roads, and (3) toll level. Expressway traffic (pcu/day) estimated under various time values (P/min/pcu) and toll rates is presented below:

Toll	First Stage (Year 2000) Time Value: P 0.7	Second Stage (Year 2010) P 1.0	Third Stage (Year 2010) P 1.0
P 10	113,000	348,000	394,000
P 20	79,000	245,000	269,000
P 30	39,000	190,000	205,000

Note : Time value estimated by DOTC was used.

6. INVESTMENT COST

Investment cost of MMUES was estimated at 55.2 billion pesos in March 1992 prices. Construction cost comprises of 25.8 billion pesos (or 53%) of the foreign currency component and 22.8 billion pesos (or 47%) of the local currency component.

Unit : Billion Pesos (March 1992 Prices)

Stage	Construction Cost	Right-of-way Acquisition Cost	Total
First Stage	20.7	2.6	23.3
Second Stage	20.5	3.3	23.8
Third Stage	7.4	0.7	8.1
Total	48.6	6.6	55.2

(Exchange Rates in March 1992: 1 P = 5.00 Yen, 1 US$ = 25.50 Pesos)

7. ECONOMIC AND FINANCIAL VIABILITY

To examine a range of economic and financial viability and optimum timing of opening year and toll level for each development stage, preliminary economic and financial evaluations were undertaken.

- Economic analysis was made by comparing the annualized project cost (computed under the assumptions of project life of 20 years and discount rate of 15%) with annual benefits. The project will be economically feasible under the following conditions:

- Toll level of 10 pesos or below for First Stage and 20 pesos for Second Stage
- Opening year of First Stage and Second Stage is no earlier than year 2000 and 2010, respectively

- Financial analysis was carried out by comparing the annualized cost (computed under the conditions of project life of 30 years and interest rate of 5% per annum) with annual revenue. It was estimated that annual revenue would not exceed the annualized project cost before year 2010 under any cases of toll levels ranging from 10 pesos to 30 pesos. Therefore, the project is difficult to be justified from the financial viewpoint, unless long term soft loan of which interest rate per annum is less than 5% is secured.

- The option solution from the economic aspect (₱10 for the First Stage and ₱20 for the Second Stage) would generate a toll revenue of 20 to 30% less than that of the most financially profitable option (₱20 for the First Stage and ₱30 for the Second Stage). Therefore, toll rates and implementation timing must be decided in due consideration of both economic and financial aspects.

8. ENVIRONMENTAL IMPACT

Environmental impacts on land use, air quality, noise, vibration, water quality, relocation of affected people and land acquisition were qualitatively assessed. No serious adverse impacts are expected except for relocation of affected people and land acquisition.

Number of households to be dislocated by the project is roughly estimated to be about 9,200, among which squatters are 5,500. In order to mitigate adverse social impacts, the Government should take measures such as purchase of land at a prevailing market price, arrangement of relocation site and effective utilization of spaces under an expressway for relocation site. For squatters, the Government should provide a relocation site as close to the place where they are settling as possible.

9. IMPLEMENTATION SCHEDULE

Based on economic and financial analysis and construction duration, the target of opening year of each stage was recommended as follows:

STAGE	EXPRESSWAY LENGTH (km)	TARGET OF OPENING YEAR	IMPLEMENTATION PERIOD
FIRST STAGE	60	Year 2006	1995-2005 (11 years)
SECOND STAGE	66	Year 2012	2001-2011 (11 years)
THIRD STAGE	24	Year 2014	2007-2013 (7 years)
TOTAL	150		1995-2013 (19 years)

10. RECOMMENDATIONS

Project Preparation

- Considering the time required for fund preparation, right-of-way acquisition and construction, project preparation should be started as soon as possible.

Implementing Body

- From the viewpoints of raising funds required for MMUES, a single and exclusive body attached to the Government would be preferred to ensure uniform operation and efficient traffic management. A body shall be capable of planning, design and construction supervision and R.O.W. acquisition as well as BOT type project implementation under the private sector financing.

Financing

- Considering the intensive investment required for the project, the combined public/private sector funding system would be recommended.
- The full utilization of soft loan from international lending institutions shall be positively pursued.
- Private participation in a form of BOT or similar shall be encouraged at the maximum extent providing that public interest is protected.

Right-of-way Acquisition

- To ensure the smooth implementation of the project, a new and drastic system for R.O.W. acquisition shall be developed. For example, private land valuation for R.O.W. acquisition shall be based on prevailing market prices, and also the Government shall be solely responsible for arranging new relocations sites for those affected.

Improvement of At-Grade Roads

- The planned at-grade roads projects shall be timely implemented well ahead of construction of related expressways, particularly missing sections of C-2, C-3 and C-5, and additional distributor roads outside EDSA, among others.
- Construction of at-grade roads along R-2 and C-6 alignments is suggested. At least, proposed alignments shall be fixed and R.O.W. shall be acquired.
- Grade separations at intersections shall be designed to be compatible with proposed expressways.

B. FEASIBILITY STUDY

1. INTRODUCTION

During the master plan study stage, the following six expressways were evaluated as the high priority corridors, all of which correspond to those included in the First Stage Expressways, and were subjected for a feasibility study:

Expressway Route C-3	15.9 kms.
Expressway Route R-3	20.2 kms.
Expressway R-4 (From Route C-3 to Makati Access Ramp)	2.4 kms.
Expressway Route R-7	12.3 kms.
Expressway Route R-9	4.5 kms.
Expressway R-10 (From Moriones Avenue to Route C-3)	3.3 kms.
TOTAL	58.6 kms.

2. CONSTRUCTION PHASING OF FIRST STAGE EXPRESSWAYS

The First Stage Expressways will be implemented in two phases. The expressways to be implemented in the Phase-1 were selected in due consideration of expressway traffic volume, implementation aspects, expressway network appropriateness and are shown below:

Expressway Route C-3 (From Route R-3 to Route R-9)	11.6 kms.
Expressway Route R-3 (From Quirino Avenue to Bicutan Interchange)	11.3 kms.
Expressway Route R-9 (Full Stretch)	4.5 kms.
TOTAL	27.4 kms.

The rest of the expressways (31.2) will be implemented in the Phase-2.

3. EXPRESSWAY TRAFFIC

Traffic volume which utilizes expressways was estimated for three toll levels and by construction phase, as shown below:

Unit: pcu/day

Toll Level (Flat toll)	FIRST STAGE		
	Phase-1 (Year 2002)	Phase-2 (Year 2006)	Year 2010
₱10.00	88,000	186,000	244,000
₱20.00	53,000	137,000	196,000
₱30.00	16,000	108,000	147,000

4. INVESTMENT COST

Required investment cost was estimated at 26 billion pesos for the First Stage, consisting of 13.3 billion pesos in Phase-1 and 12.7 billion pesos in Phase-2.

Unit: Billion Pesos in April 1993 prices

	Phase-1	Phase-2	Total
Detailed Engineering Cost	0.29	0.28	0.57
ROW Acquisition Cost	1.04	1.17	2.21
Construction Cost	11.57	10.79	22.36
Construction Supervision Cost	0.47	0.43	0.90
Total	13.37	12.67	26.04

(Exchange Rates in April 1993: 1.00 ₱ = 4.50 Yen, 1 US$ = 25.50 Pesos)

Operating cost and maintenance cost per km. per year were estimated at 1.36 million pesos and 1.02 million pesos, respectively.

5. ECONOMIC EVALUATION

Traffic congestion on the at-grade roads will be mitigated as significant traffic is diverted to expressways, resulting in improved travel speeds which derive of vehicle operating cost savings and passengers time cost savings.

Under the conditions that a toll rate is 20 pesos and economic life of the facilities is 20 years from the opening year of the Phase-2 (or year 2006), results of the economic analysis were as follows:

Economic Internal Rate of Return (EIRR) - - - - - - - - - -24.0 %
B/C Ratio (discount rate at 15%) - - - - - - - - - - - - - - - 2.87
Net Present Value (discount rate at 15%) - - - - - - - - -22.4 Billion Pesos

Even when the cost increases by 30% and the benefit reduces by 30%, EIRR was estimated to be 18.7% which is higher than the opportunity cost of capital (15%) in the Philippines. The project was evaluated economically feasible.

6. FINANCIAL EVALUATION

In order to evaluate the range of the investment return, financial internal rate of returns for the various cases were estimated. The base case assumed a toll rate of 20 pesos.

	Financial Rate of Return (FIRR)
Base Case	3.9%
20% decrease in revenue	2.3%
20% increase in cost	2.7%
20% increase in revenue and 10% reduction in cost	5.9%
20% decrease in revenue and 20% increase in cost	2.0%

Above results imply that the project is financially feasible only when it is financed with soft loans of which interest rates of about less than 3.9% per annum under the base case, and less than 2.0% per annum under the worst case.

7. ENVIRONMENTAL IMPACTS

Environmental impacts on the following items were qualitatively assessed:

Land Use: The project will guide and promote urban expansion, thus the project generally provides favorable impact. However, rapid urbanization to be induced by expressways may require coordination and integration of city development plans with MMUES plan to maximize the benefits of the project at local community level and to minimize adverse environmental impact.

Air Quality: An expressway network will speed up traffic flow, improve fuel efficiency and reduce vehicular emission rates, therefore, the project will have a favorable impact on air quality.

Noise: As the earthworks which require heavy equipment is not extensive, noise level during construction will not cause serious problem. However, bored piles should be selected as a type of pile foundation and driving piles should not be used. During operation stage, adjacent areas to an expressway would suffer noise problem, therefore, necessary measures such as installation of noise barriers, control of overloaded trucks, etc. should be implemented.

Vibration: No significant adverse effect due to equipment-induced and traffic induced vibration during construction and operation stages.

Relocation of Affected People and ROW Acquisition: The project requires about 149,300 square meters land acquisition and relocation of about 4,570 families of which about 4,310 families are squatters. In order to mitigate adverse social impact, the Government should implement necessary measures such as purchase of lands at a prevailing market price, effective utilization of space under an expressway for relocation site, making arrangement of relocation site for affected people, etc.

8. PROJECT IMPLEMENTATION

Implementation schedule was proposed as follows:

	Phase-1	Phase-2
Detailed Engineering Design	1995-1996 (2 years)	1998-2001 (3.5 years)
ROW Acquisition	1996-2000 (4 years)	1999-2004 (5.5 years)
Construction	1997-2001 (4.5 years)	2000-2005 (5.5 years)
Construction Supervision	1997-2001 (4.5 years)	2000-2005 (5.5 years)
Total	1995-2001 (7 years)	1998-2005 (8 years)

It was recommended that the Government should seriously consider to create a public corporation for implementation of the project in order to utilize private funds and to make possible the unified operation, management and maintenance of MMUES.

As demonstrated by the financial analysis, the Government must secure long-term soft loans (interest rate of about 3% per annum) from international financial institutions as much as possible.

9. RECOMMENDATIONS

Implementing Body: The Government must determine the implementing body at the earliest possible time, whether the project is implemented by the Government, or by a public corporation or by a private sector in a form of BOT or BT Scheme. It will be one of the ways to advertise the project as BOT or BT to invite interested private investors, however, it would be very difficult from the financial viewpoint to implement the project relying heavily on a private sector.

Revenue Pooling System for Repayment: This system was recommended due to the following reasons:

- MMUES must be developed in a balanced manner, nonetheless a component expressway is profitable or not.

- MMUES will be implemented by stages. Each route will be opened in different year. However, to charge different toll to different route in one system would be very inconvenient for expressway users and very difficult to operate and manage MMUES on the part of the expressway operator.

Toll Level: The project is economically feasible, therefore, toll rate will be determined, focusing on financial aspect and other factors that the Government considers important.

Coordination With Other Agencies: Coordination with other agencies such as PNR for utilization of its right-of-way and LGUs for development control within the proposed expressway right-of-way must be started as soon as possible.

Right-of-way Acquisition: As ROW acquisition is one of the major bottlenecks for smooth implementation, the Government should introduce drastic measures such as effective utilization of space under an expressway, urban re-development at interchange sites, multiple utilization of PNR right-of-way, etc.

Development of At-grade Roads: Development of at-grade roads, not only those over which an expressway will be built but also those which will increase efficiency of an expressway should be positively pursued.

TABLE OF CONTENTS

A. MASTER PLAN FOR METRO MANILA URBAN EXPRESSWAY SYSTEM (MMUES)

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Metro Manila with its concentration of people and economic activities is growing rapidly. Similar with other metropolitan areas of the developing world, this expansion has continued to produce far reaching and complex problems, namely: unorderly development of urban areas, aggravation of urban environment and a progressively inefficient urban transportation system.

The present road network consisting of 3,091 km of public roads, of which about 907 km are classified as national roads, has become inadequate to meet the travel demands of the expanding metropolis. The network is characterized by partially developed primary road system, lack of well planned and developed secondary arterial and distributor roads, uncoordinated and inaccessible private roads and inadequate and often outdated pavement, drainage structures and road appurtenances.

The deterioration of the road condition and the public transport services have greatly inconvenienced the daily commuters and motorists, wasted valuable resources, compromised safety and environmental stability, and adversely affected economic activities.

The heavy traffic congestion in the inner area of Metro Manila (inside C-4 or EDSA) needs strengthening of the road network to improve the situation. Important missing road links are under various stages or implementation. Due however, to the heavy roadside developments, widening of existing primary roads are expensive and difficult. The high rate of increase in the transport demand will saturate the road network in the very near future unless expansion of the road network is undertaken.

The establishment of an urban expressway system for Metro Manila and the conduct of a detailed feasibility study of identified priority section is urgently needed to cope up with transport problems.

1.2 OBJECTIVES OF THE STUDY

The objectives of the Study are as follows:

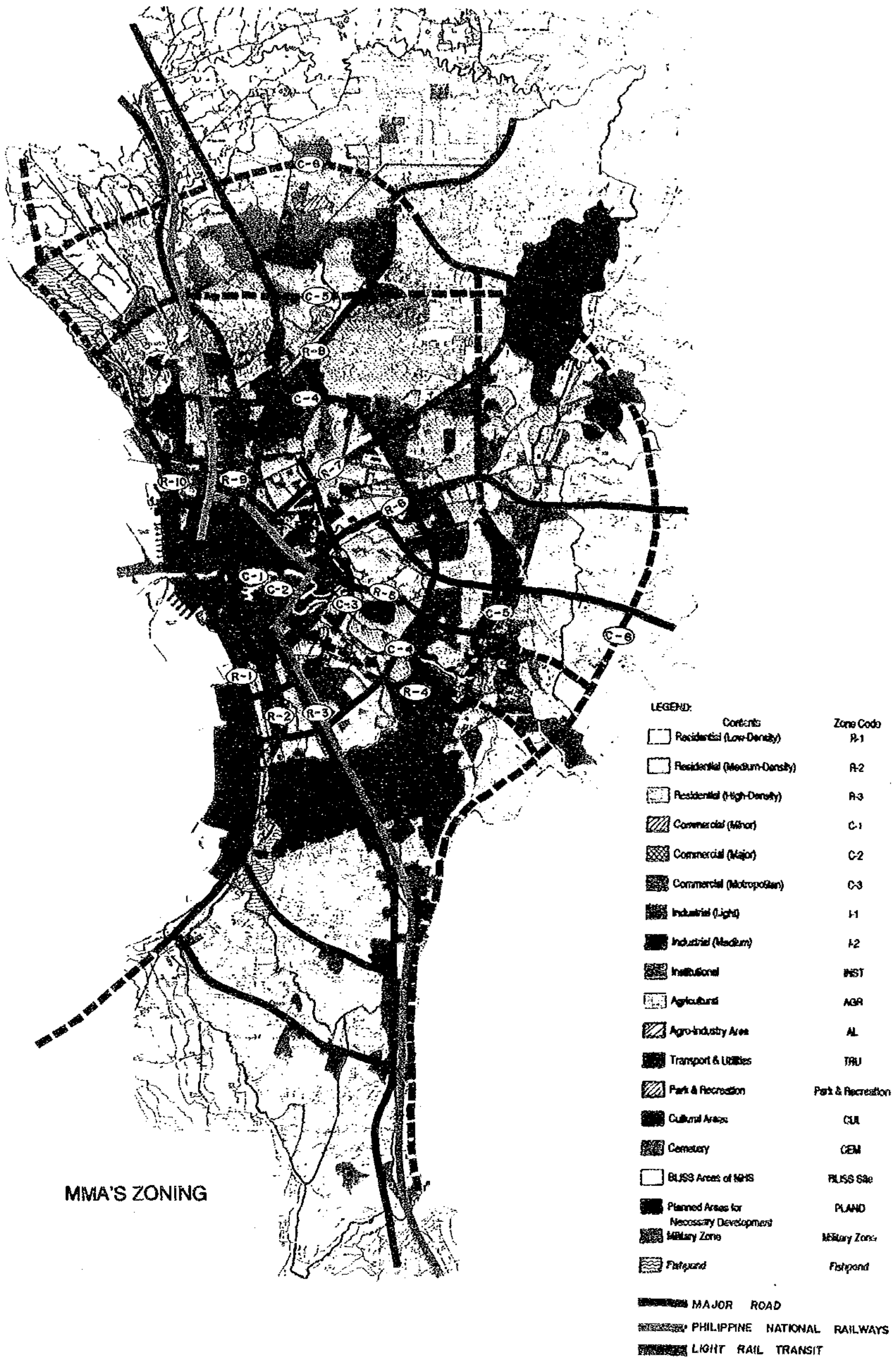
- Master plan study shall be conducted on the Intra-Urban Expressway Network System in Metro Manila to select high priority corridors in the system, taking into consideration transportation and infrastructure development plans in this region.

- Feasibility study shall be undertaken on the high priority corridors of the system taking into consideration the resource implication, both physical and financial.

1.3 STUDY AREA

The study area shall cover the whole of Metro Manila.

FIGURE 1.1 METRO MANILA URBAN TRANSPORT SYSTEM



2. SOCIO-ECONOMIC PROFILE

2.1 LOCATION

The Metropolitan Manila Area, called as the National Capital Region or Metro Manila, comprises four cities and thirteen municipalities, encompassing an area of 636 sq. km. Metro Manila is strategically located in the center of Luzon Island, linking the northern sector and the southern sector of Luzon Island. The growth of Metro Manila has spilled over to the adjoining provinces of Bulacan, Rizal, Laguna and Cavite, integrating significant portions as an actual part of the Metropolitan Manila Area.

2.2 SOCIO-ECONOMIC PROFILE

Despite the decentralization and regionalization thrusts of the government, Metro Manila still exerts a dominant influence on the rest of the country. It is the center of administration, business, commercial, industrial and cultural activities.

About 13% of the nation's population (or about 8 million) settle in Metro Manila which shares only 0.2% of land area of the country. Metro Manila produces about one-third of the nation's economic output, employs about 12% of the nation's employment and registers about 42% of the nation's motor vehicles (see Table 2.1).

2.3 REGIONAL ECONOMY

Metro Manila's economy slowly recovered from the slump experienced in 1984 to 1986 and posted a 6.1 percent average annual growth between 1986 to 1988. In absolute terms, the real regional output improved from P23.5 million in 1986 to P31.0 million in 1988 (1972 prices). (See Figure 2.1).

The economy of Metro Manila is dominated by the tertiary sector and secondary sector. The former shares 63% of the gross regional domestic product while the latter, 37%. In addition to these formal sectors, it is to be noted that the shares of the various services of the informal sector are also significant, directly and indirectly affecting urban and transportation developments in Metro Manila. (See Figure 2.2).

TABLE 2.1 METRO MANILA'S SOCIO-ECONOMIC INDICES

ITEM	YEAR	METRO MANILA		PHILIPPINES		% SHARE OF MM
1. Area: sq km	–	636		300,000		0.2
2. Population: 000 persons	1990	7,929		60,685		13.1
3. Population Density: /sq km	1990	12,467		202		–
4. Population Growth Rate: %/year	1980 – 1990	2.95		2.35		–
5. GDP: Billion Pesos	1989	310		937		32.0
6. GDP Growth Rate: %/year	1985 – 1989	5.7		4.5		–
7. Per Capita GDP: Pesos	1989	39,914		16,040		–
8. Employment: 000 persons (%)	1990	2,718		22,532		12.0
– Primary	1990	41	(1.5)	10,323	(45.8)	0.4
– Secondary	1990	759	(27.9)	3,253	(14.4)	23.0
– Tertiary	1990	1,918	(70.6)	8,956	(39.8)	21.0
9. Unemployment Rate: %	1990	14.1		8.1		–
10. Underemployment Rate: %	1990	13.1		22.1		–
11. Incidence of Poverty: %	1988	31.8		49.5		–
12. Monthly Family Income: Pesos	1988	6,610		3,367		–
13. Inflation Rate: %/year	1990	14.9		12.7		–
14. No. of Motor Vehicles (MVs) Registered	1990	685		1,620		42.0
15. Growth Rate of MVs Registered: %/year	1985 – 1990	8.1		7.7		–
16. No. of Cars Registered	1990	307		455		67.0
17. Growth Rate of Cars Registered: %/Year	1985 – 1990	6.7		5.5		–

Source: 1991 Philippine Statistical Yearbook

FIGURE 2.1 GROWTH TRENDS OF NCR ECONOMY

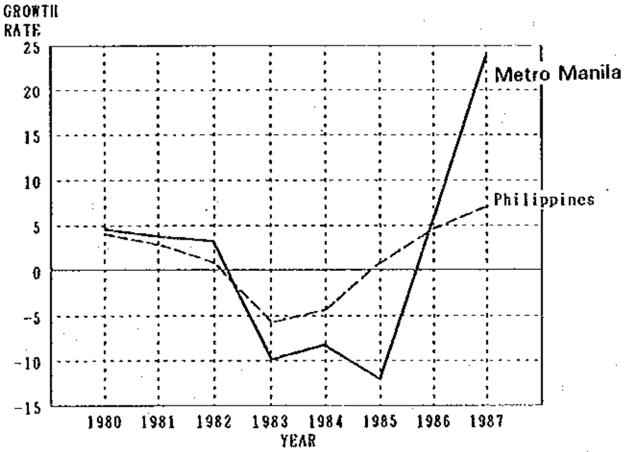
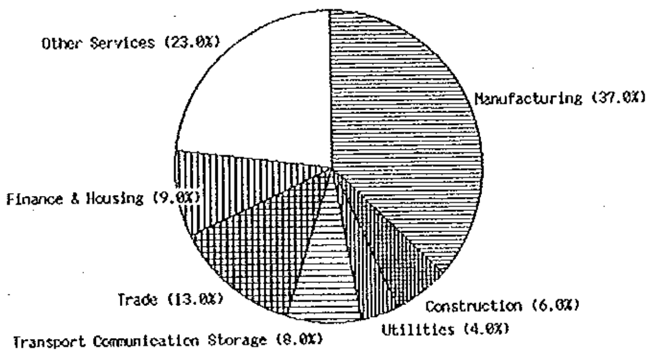


FIGURE 2.2 SECTORAL COMPOSITION OF NCR ECONOMY (1988)



3. URBAN STRUCTURE

3.1 URBAN STRUCTURE

The present urban structure of Metro Manila may be described as a radial-satellite pattern, with the City of Manila, Makati and Cubao/Ortigas in the center, as depicted in Figure 3.1.

As commonly observed in large urban areas which are only served by roads, the growth of a strong CBD is limited due to constrained accessibilities. The traditional CBD in Manila seems to have reached more or less its saturation level around 1980, while other sub-urban center have grown rapidly, especially along EDSA, which has large transport capacities. Especially, some urban centers developed at the strong initiative of the private sector such as Makati, Ortigas, Cubao, etc., contribute to the development of an adequate hierarchal urban system greatly.

Along with major transport corridors, suburban centers have further developed and linked with those in Metro Manila. As the actual urban areas of Metro Manila extend beyond its administrative boundary, the adjoining areas in Cavite, Laguna, Rizal, and Bulacan have been getting integrated with the metropolitan system.

It is anticipated that the growing unconventional CBDs, especially Makati and Ortigas would play more and more important role in the future to such an extent that they would affect the traffic distribution significantly. Limited accessibilities due to almost total reliance to road transport, other urban/suburban centers would also farther grow continuously.

3.2 MAJOR TRAFFIC GENERATING SOURCES

Major traffic generating sources in Metro Manila are shown in Figure 3.2.

3.3 URBANIZATION TREND

- Urbanization extends not only to the entire Metro Manila area but outside Metro Manila as well, such as Meycauayan (north), Cainta (east), and San Pedro (south).
- Population has been spreading towards the outer areas rapidly, while it has started to decrease in the inner areas. (See Figure 3.3).
- Employment in many of the inner areas, except some major growth centers, has been declining together with population. Strong concentration is observed in areas along EDSA. (See Figure 3.4).
- Commercial land use spread mostly to the north and south, proportionate with urbanization. Big commercial complexes were constructed, especially along EDSA, during the last 15 years.
- Most of the industrial development occurred in the mid-1980's as a result of MMA's landuse policies and the rapid distribution of population, leaving no more room for further developments in the 1990s.

FIGURE 3.1
PRESENT URBAN STRUCTURE OF METRO MANILA

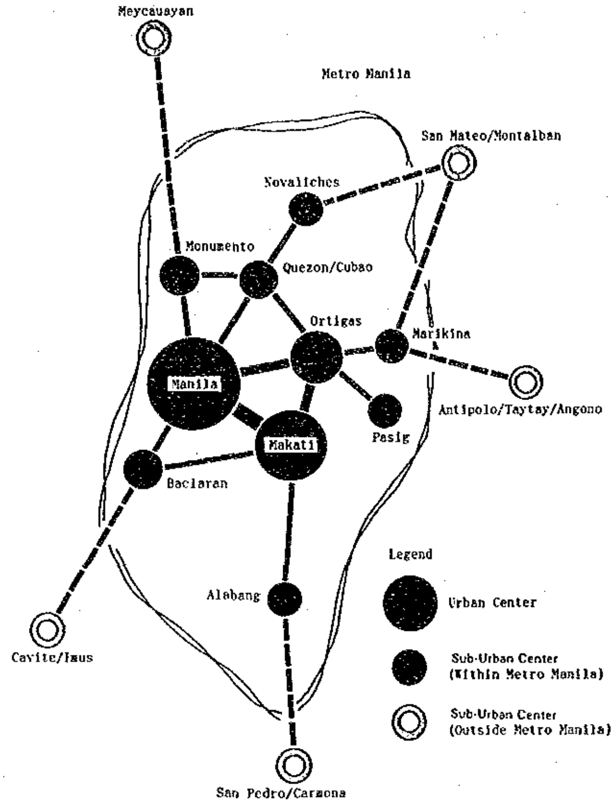


FIGURE 3.2
MAJOR TRAFFIC GENERATION AREAS/FACILITIES

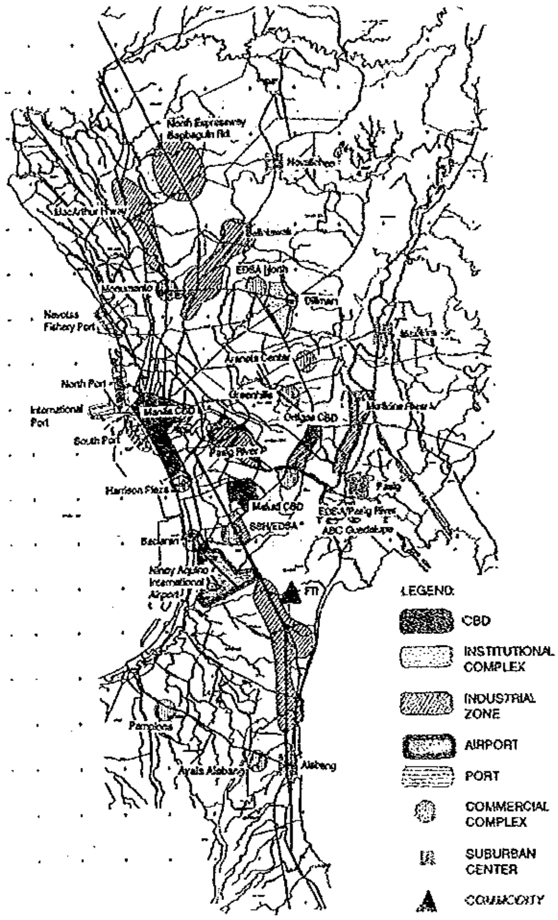


FIGURE 3.3
CHANGES IN POPULATION DISTRIBUTION BETWEEN 1980 AND 1990

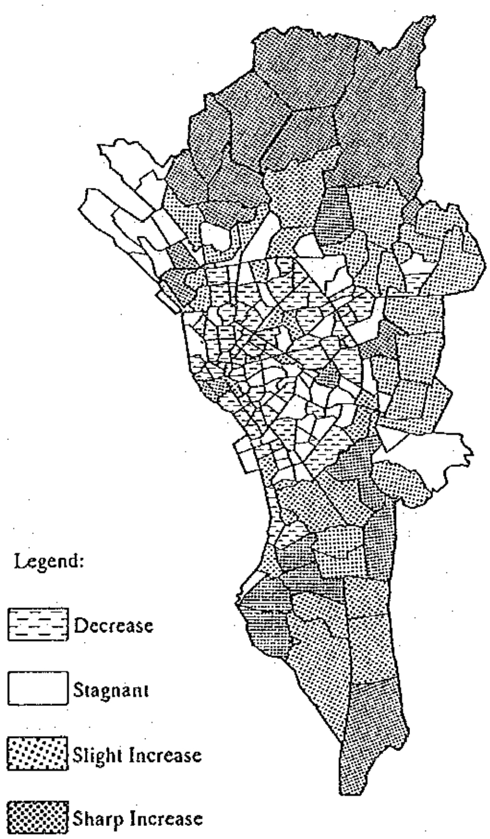
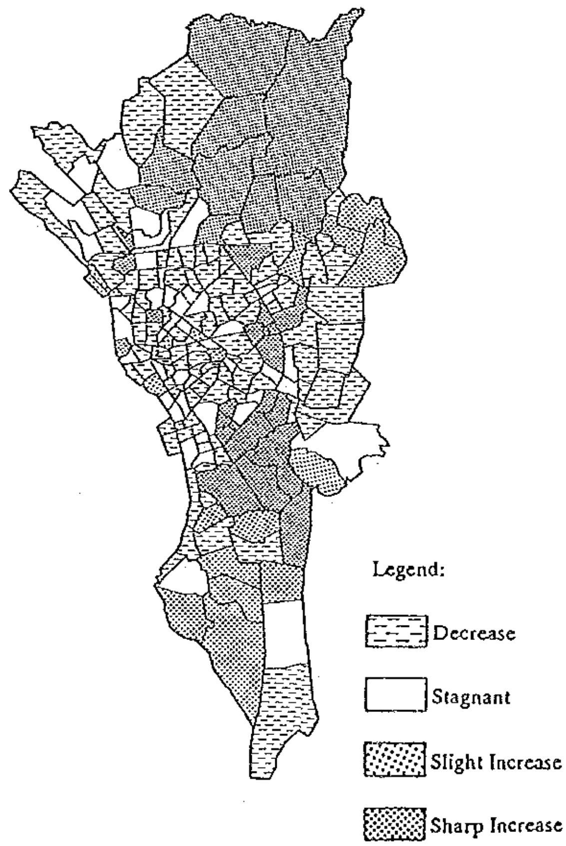


FIGURE 3.4
CHANGES IN EMPLOYMENT TREND BETWEEN 1980 AND 1990



4. URBAN TRANSPORTATION

4.1 CURRENT URBAN TRANSPORT DEMAND

Urban transport demand of Metro Manila in terms of person trips in 1990 is 13.6 million a day, reflecting a growth from the 10.6 million a day in 1980 or by 28% or an average growth rate of 2.5% a year during the decade. (See Table 4.1).

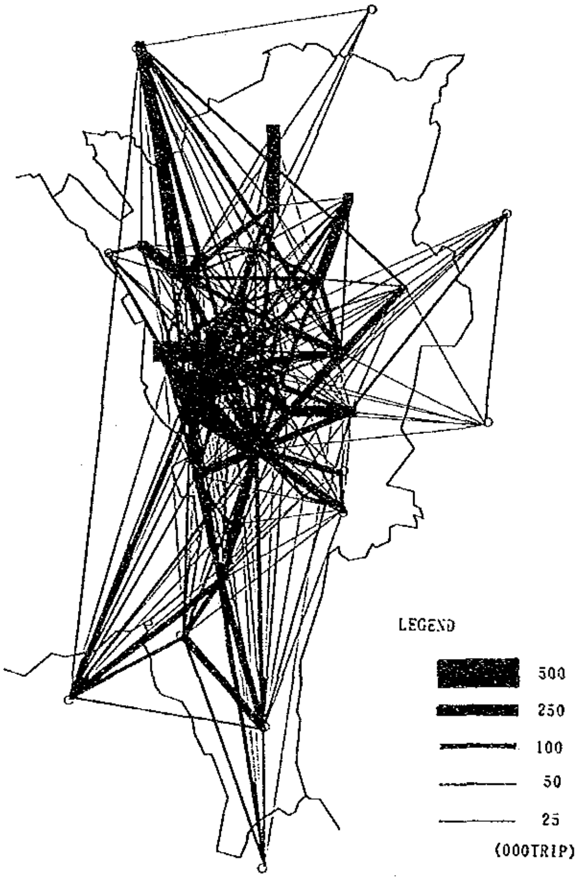
- Due to the stagnant economic growth during the decade, transport demand has grown slower than population (2.9%/year).
- Road transport plays a dominant role sharing 97% of the total transport demand.
- Although public transport still dominates urban transport demand, the share of private transport increased from 24% to 26%.
- Tricycle shares has become significant which is probably due to the progress of suburbanization.
- LRT still shares minimal percentage in total demand, while PNR's role is almost negligible.

4.2 TRANSPORT DEMAND DISTRIBUTION

Metro Manila's transport demand distribution is shown in Figure 4.2

- The overall traffic demand is distributed over the entire Metro Manila and between adjoining provinces. This pattern is quite different from the one in 1980 when the traffic demand distributes more within Metro Manila with relatively heavy concentration in the city center and some growth centers such as Makati.
- The change in traffic distribution is particularly true for private transport demand. The largest traffic generating center seems to be Makati, followed by Manila and a number of growing centers in the north, south, and east.
- The public transport sector demand still concentrates in the Manila CBD.
- As urbanization progresses, traffic demand increases and traffic distribution becomes more and more complex especially when accessibilities are constrained due to the lack of transport facilities. The availability of transport facilities has started to affect the traffic demand distribution significantly in Metro Manila.
- In summary, it seems that the public transport demand complies with the radial-circumferential roads pattern while that of private transport demand is more along the north-south directions.

FIGURE 4.2
TRANSPORT DEMAND DISTRIBUTION IN METRO MANILA

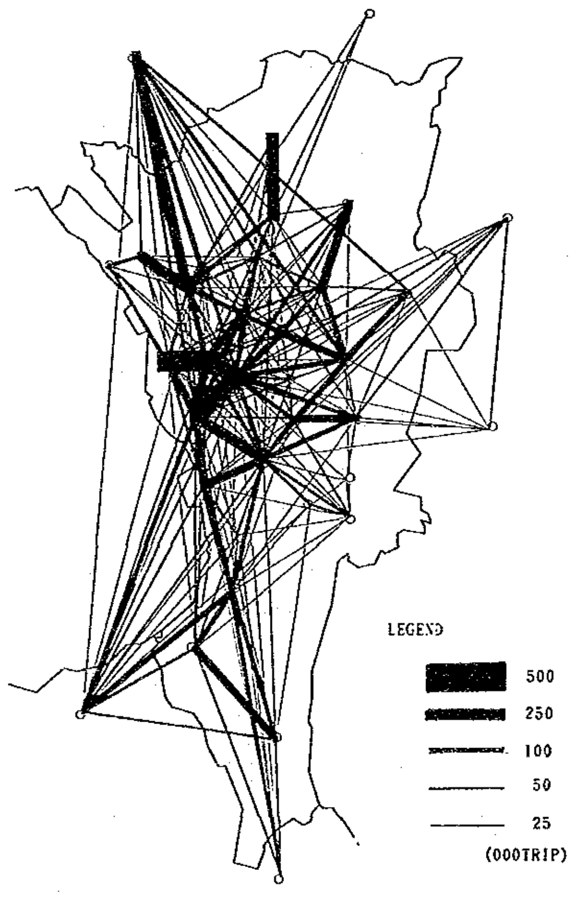


1990 TOTAL (persons)

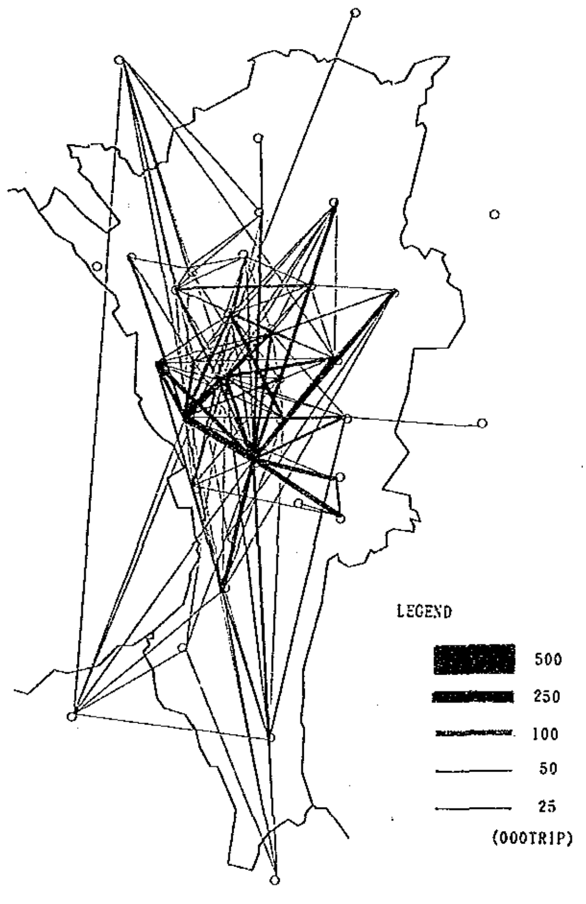
TABLE 4.1 METRO MANILA TRAFFIC DEMAND BY MODE

	1980		1990	
	(000)	(%)	(000)	(%)
Private				
Car/Jeep	1,684	15.9	3,378	24.8
Truck/Others	861	8.1	163	1.2
Sub–Total	2,554	24.0	3,541	26.0
Public				
PNR	10	0.1	14	0.1
LRT	–	–	381	2.8
Bus	1,674	15.7	1,825	13.4
Jeepney	5,796	54.5	6,061	44.5
Tricycle	430	4.0	1,566	11.5
Taxi	168	1.6	232	1.7
Sub–Total	8,078	76.0	10,079	74.0
Total	10,633	100.0	13,620	100.0

Source: JUMSUT and 1990 HIS



1990 PUBLIC (persons)



1990 PRIVATE (persons)

5. ROAD NETWORK AND ROAD TRAFFIC

5.1 ROAD NETWORK

Metro Manila's transport network is composed of a set of radial and circumferential major roads which are supplemented with secondary and tertiary roads, PNR lines, a LRT line and a limited waterway (see Figure 5.1).

Basic major road network consists of 10 radials and 6 circumferentials. At present, radial roads are mostly developed, however, circumferential roads are still less than halfway to be completed. Although these incomplete sections are under construction or in the implementation pipeline, the overall progress tends to be delayed due mainly to ROW acquisition and squatter problems. At-grade roads development in the future is getting to be increasingly difficult, thus, the development of an elevated expressway system and mass-transit systems such as PNR commuter service and LRT expansion at the earliest time, is also badly needed.

5.2 ROAD TRAFFIC

Traffic conditions on Metro Manila roads have been changing significantly. (See Figure 5.2).

- Traffic concentration in the inner center has become less significant

- The traffic volumes along EDSA, South Super Highway and Quezon Avenue have increased tremendously. EDSA carries 100,000 to 200,000 pcus along major sections, South Super Highway between 80,000 to 120,000 pcus and Quezon Avenue between 60,000 to 100,000 pcus.

- Due to lack of road traffic capacities along radials, many of which have already reached their capacities during the 1980's, the role of circumferentials have become critical.

- Traffic volumes at radial roads along sections outside EDSA have more significant increase. In view of the lack of roads in areas outside EDSA, the continuing tendency in traffic demand increase in these areas would further worsen the traffic situation.

- From the public transport viewpoint, bus traffic is relatively concentrated along South Super Highway (outside EDSA)/EDSA/Quezon Avenue (outside EDSA), and Taft Avenue only. Jeepneys can be found all over Metro Manila, sharing normally from 20 to 50% of the total traffic volume.

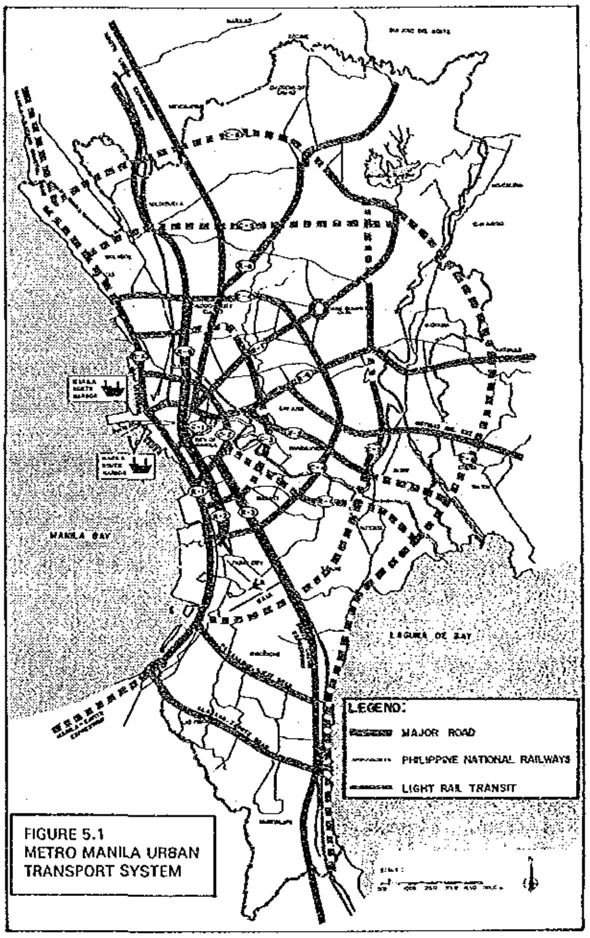
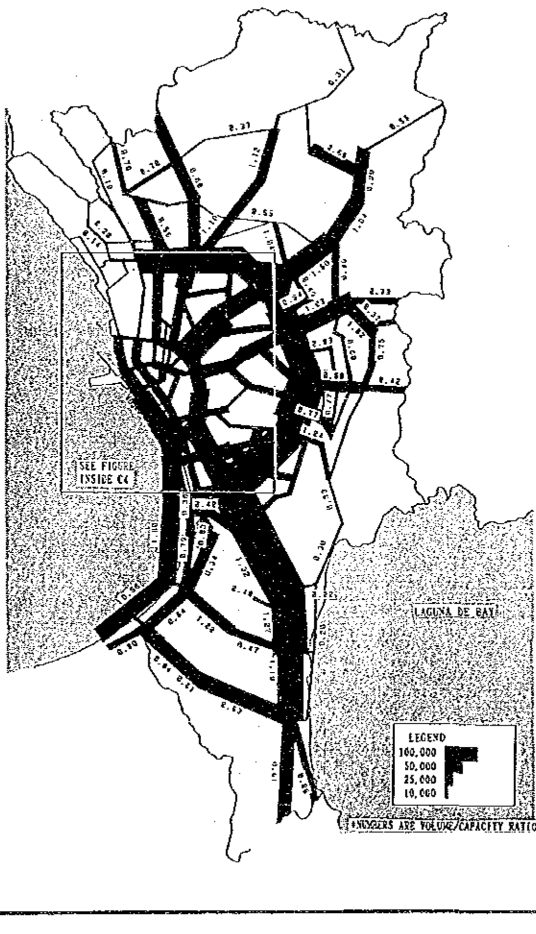
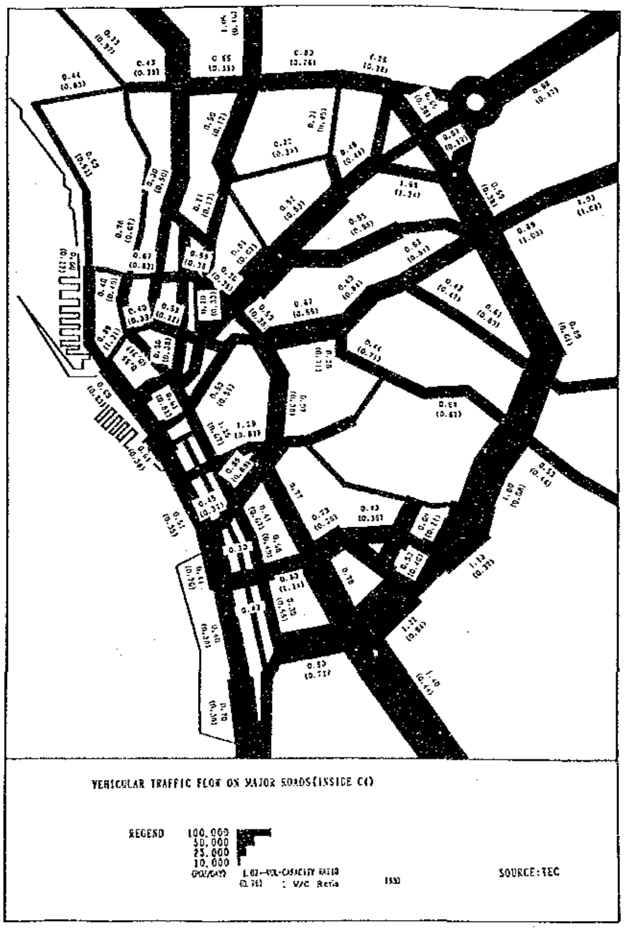


FIGURE 5.1
METRO MANILA URBAN TRANSPORT SYSTEM

FIGURE 5.2 ROAD TRAFFIC VOLUME ON MAJOR ROADS





6. FUTURE SOCIO-ECONOMIC FRAMEWORK AND TRANSPORT DEMAND

6.1 FUTURE SOCIO-ECONOMIC FRAMEWORK

Socio-economic parameters were forecasted for years 2000 and 2010, based on Metro Manila Authority's zoning, DOTC's Metro Manila Urban Transport Development Project, and other data as shown in Table 6.1 and Figure 6.1.

6.2 FUTURE TRANSPORT DEMAND

The total number of trips for Metro Manila was estimated to be approximately 18 million and 22 million trips for years 2000 and 2010, respectively (See Table 6.2). Share of private modes is expected to increase from 26.0% in 1990 to 34.5% in 2000 and 38.9% in 2010, in terms of person trips. In terms of vehicles in pcu, private mode vehicle trips will sharply grow at an average growth rate of 4.4% per annum between years 1990-2010. In 2010, share of private modes will be about 75%.

In order to understand the characteristics of private trip demand in more realistic manner, the trip demand in the form of OD tables has been assigned on spider network. (See Figure 6.2).

- Overall demand assigned on spider network shows that the actual road network relatively well coincides with demand distribution pattern. This is to say that Metro Manila's road network is basically structured in such a way that it meet more directly the traffic demand, unlike many other cities where they are quite different to each other.
- Overall distribution pattern of private trips is, however, not in radial/circumferential pattern but rather north-south directions mixed with radials. Axis via Makati area show the most significant private trip distribution with strong links with traditional Manila CBD, Quezon City as well as suburban areas of north, east and north.

Traffic congestions which are currently experienced in the Makati CBD area, along EDSA and SSH/MSR, and in many radial roads outside EDSA would, therefore, be further accelerated in the future.

TABLE 6.1
SOCIO-ECONOMIC FRAMEWORK FOR METRO MANILA

PARAMETER	1980	1990	2000	2010	AVERAGE GROWTH RATE (%/YR.) 1980–1990	1990–2000	2000–2010
1) Population (000)	5,926	7,929	9,837	11,416	3.0	2.2	1.5
2) Employment at Residence (000)	1,781	2,701	3,384	3,984	4.3	2.3	1.7
3) Employment at Work Place (000)	1,874	2,836	3,638	4,382	4.2	2.5	1.9
4) School Atten–dance at Residence (000)	1,707	1,868	2,243	2,512	0.9	1.9	1.1
5) School Atten–dance at School Place (000)	1,765	2,243	2,580	2,763	2.4	1.4	0.7
6) Car–ownership (no/000 population)	295	556	1,065	1,503	6.6	6.7	3.5

FIGURE 6.1
POPULATION DISTRIBUTION IN METRO MANILA (1980-2010)

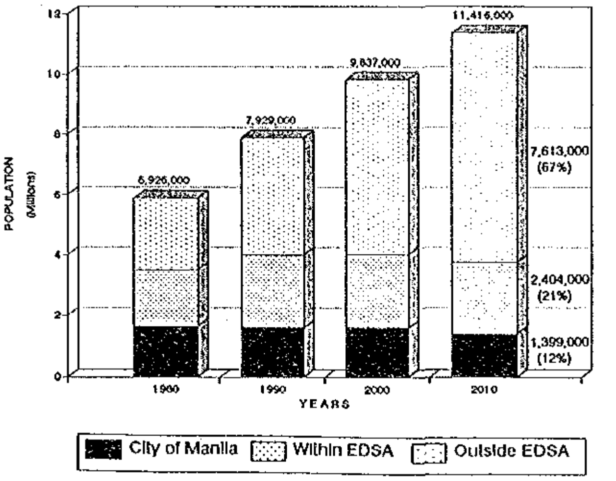


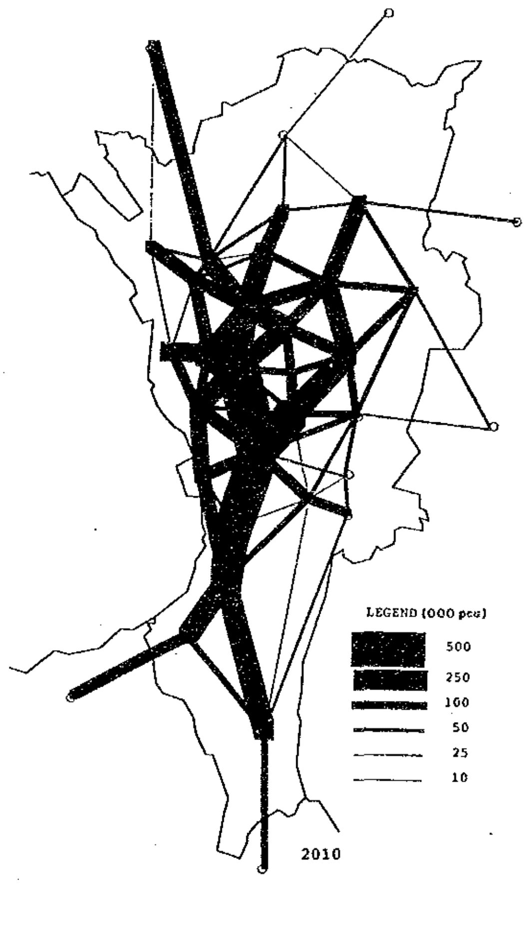
TABLE 6.2 ESTIMATED TRAFFIC DEMAND OF METRO MANILA

	1990		2000		2010	
	000/day	%	000/day	%	000/day	%
1. Persons						
– Public Modes[1]	10,079	74.0	11,840	65.5	13,207	61.1
– Private Modes	3,541	26.0	6,229	34.5	8,396	38.9
Total	13,620	100.0	18,069	100.0	21,603	100.0
2. Vehicles (PCU)						
– Public Modes[2]	968	38.5	1,104	29.0	1,221	25.1
– Private Modes	1,546	61.5	2,709	71.0	3,650	74.9
Total	2,514	100.0	3,813	100.0	4,871	100.0

1/ Including those using rail (PNR/LRT)

2/ Excluding those of rail demand (0.4, 0.8 and 1.2 million for years 1990, 2000, and 2010, respectively). Assumed PCU conversion factor private transport and for road–based public transport modes is 2.3 and 10, respectively.

FIGURE 6.2
ROAD TRAFFIC DISTRIBUTION ON SPIDER NETWORK
(PRIVATE ONLY)



7. RELATED TRANSPORT PROJECTS

Related transport projects regarded as one of the pre-conditions for expressway network planning are shown in Figure 7.1.

Major road projects to be completed between 1996 and 2000

- C-3 between Rizal Avenue and A. Mabini Street
- C-5 (full stretch will be completed)
- Widening of North Luzon Expressway
- Extension of Shaw Boulevard, Visayas Avenue and Mindanao Avenue
- Manila-Cavite Expressway

Major road projects to be completed between 2001 and 2010

- C-3 between Shaw Boulevard and Buendia Avenue (full stretch of C-3 will be completed)
- C-6 (full stretch will be completed)
- Widening of R-10
- Additional distributor roads outside EDSA

Rail and LRT Projects to be completed by 2010

- LRT Line-2 from D. Jose Station of Line 1 to Katipunan Ave. in Quezon City via Lerma, Espana, E. Rodriguez and Aurora Blvd.
- LRT Line-3 along EDSA from F.B. Harrison in Pasay to North Ave. in Quezon City. It will be extended up to Rizal Ave. in the future.

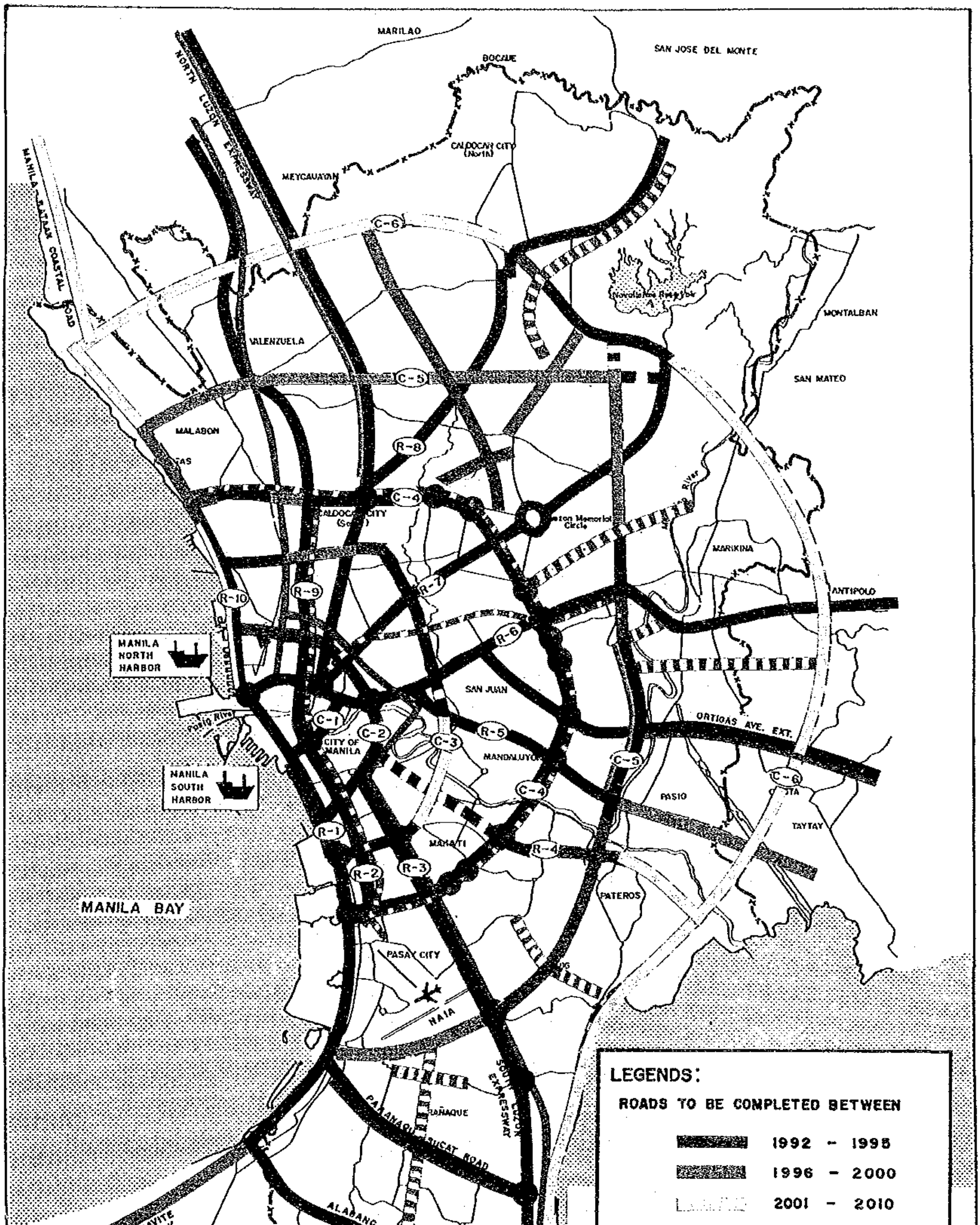


FIGURE 7.1
TRANSPORT PROJECTS
COMPLETED BY 2010

8. PRESENT AND FUTURE ROAD NETWORK PERFORMANCE

8.1 PRESENT ROAD NETWORK PERFORMANCE

The 1990 road network, as a whole, has more or less reached to its capacity, average travel speed of overall road network is about 26 km/hour. It is estimated to be about 22 km/hour inside EDSA and about 29 km/hour outside EDSA.

8.2 UNDER DO NOTHING SITUATION

If no network expansion is made, the situation will quickly worsen towards years 2000 and 2010. By year 2000, vehicle-kms (more or less traffic demand) increase by 44%, vehicle hours by 170%, thus average travel speed decreases by about 50%.

By year 2010, vehicle-kms increase by 82%, vehicle hours increase by 460% and average travel speed decreases by 70%. The situation gets worse both inside and outside EDSA. The situation in year 2010 clearly indicates that existing road network is not sufficient at all to meet the traffic demand.

8.3 UNDER DO SOMETHING SITUATION

If various road projects/plans are implemented, the traffic situation worsens less significantly. By year 2010, average travel speed on year 2000 network decreases to 11.8 km/hr and in year 2010 network to 16.4 km/hr. The traffic situation outside EDSA worsens less significantly than inside EDSA, reflecting that more road projects/plans are implemented in the areas outside EDSA.

8.4 OVERALL ASSESSMENT

- The traffic situation inside EDSA in year 2010 would be very chaotic, even though all on-going and planned road projects are completed. To construct more at-grade roads than currently planned will be increasingly difficult due to ROW acquisition problems, therefore, construction of expressways over available public spaces will be one of the key solutions to cope up with sharply increasing traffic demand.

- The traffic situation outside EDSA in year 2010 would be also critical where urbanization is rapidly progressing. As more people will reside far away from their working places, to provide faster means of transportation like an expressway is definitely needed.

- As traffic congestions worsen, it is not only vehicle-kms that would become larger but, more significantly, vehicle-hours would become tremendous.

- The effects of the currently on-going/planned major roads development are great particularly in the area outside EDSA such that their early completion should be seriously pursued.

FIGURE 8.1 ROAD TRAFFIC DISTRIBUTION ON 1990, 2000 AND 2010 ROAD NETWORK (WITHOUT EXPRESSWAYS)

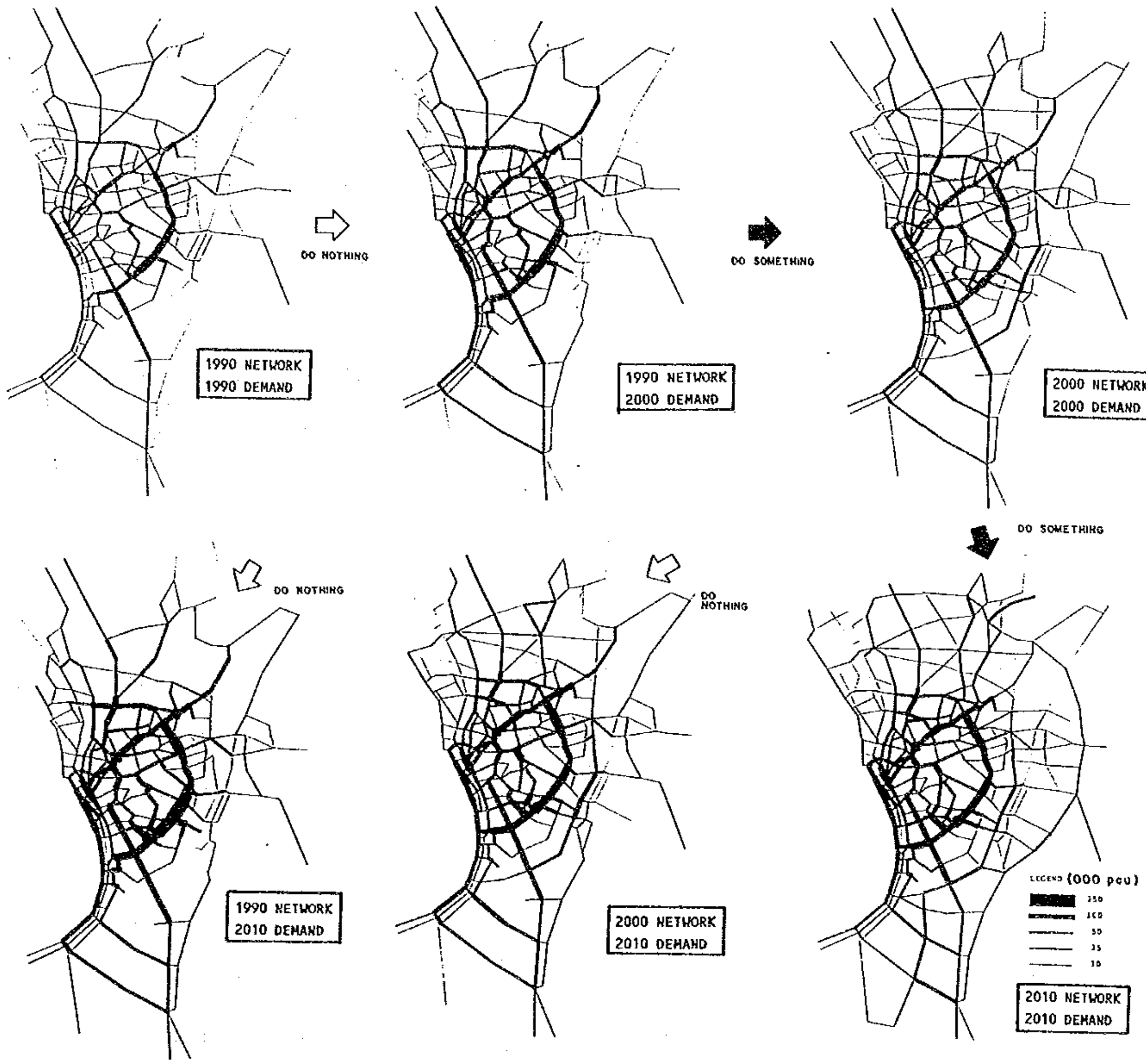


TABLE 8.1 PERFORMANCE OF ROAD NETWORK (WITHOUT EXPRESSWAY) FOR YEAR 1990, 2000 AND 2010

ENTIRE NETWORK

DE-MAND	NETWORK PERFORMANCE	ROAD NETWORK ASSUMPTIONS: 1990 (DO NOTHING)		2000 (DO SOMETHING-1)		2010 (DO SOMETHING -2)	
1990	Veh* kms: mil	18.07	100				
	Veh * hrs: mil	0.71	100				
	Ave. trip speed	25.50	100				
	Ave. V/C ratio	0.76	100				
2000	Veh* kms: mil	26.08	144	26.56	146		
	Veh * hrs: mil	1.93	271	1.28	180		
	Ave. trip speed	13.50	53	20.70	81		
	Ave. V/C ratio	1.10	144	0.91	119		
2010	Veh* kms: mil	32.95	182	34.15	188	35.35	195
	Veh * hrs: mil	3.99	561	2.89	407	2.15	302
	Ave. trip speed	8.30	32	11.80	46	16.40	64
	Ave. V/C ratio	1.39	182	1.17	153	0.99	130

(INSIDE C4)
NETWORK WITHIN EDSA

DE-MAND	NETWORK PERFORMANCE	ROAD NETWORK ASSUMPTIONS: 1990 (DO NOTHING)		2000 (DO SOMETHING-1)		2010 (DO SOMETHING -2)	
1990	Veh* kms: mil	6.70	100				
	Veh * hrs: mil	0.31	100				
	Ave. trip speed	21.60	100				
	Ave. V/C ratio	0.87	100				
2000	Veh* kms: mil	9.64	143	9.64	143		
	Veh * hrs: mil	0.83	267	0.59	190		
	Ave. trip speed	11.60	53	16.40	75		
	Ave. V/C ratio	1.25	143	1.11	127		
2010	Veh* kms: mil	11.96	178	12.17	181	12.14	181
	Veh * hrs: mil	1.58	509	1.32	425	1.04	335
	Ave. trip speed	7.60	35	9.20	42	11.70	54
	Ave. V/C ratio	1.55	178	1.40	160	1.29	148

NETWORK OUTSIDE EDSA

DE-MAND	NETWORK PERFORMANCE	ROAD NETWORK ASSUMPTIONS: 1990 (DO NOTHING)		2000 (DO SOMETHING-1)		2010 (DO SOMETHING -2)	
1990	Veh * hrs: mil	11.37	100				
	Veh * hrs: mil	0.40	100				
	Ave. trip speed	28.50	100				
	Ave. V/C ratio	0.71	100				
2000	Veh* kms: mil	16.43	144	16.92	148		
	Veh * hrs: mil	1.09	272	0.70	175		
	Ave. trip speed	15.00	52	24.30	85		
	Ave. V/C ratio	1.03	145	0.82	115		
2010	Veh* kms: mil	21.00	184	21.98	193	23.21	204
	Veh * hrs: mil	2.41	602	1.57	392	1.11	277
	Ave. trip speed	8.70	30	14.00	49	20.80	72
	Ave. V/C ratio	1.31	184	1.07	150	0.88	123

9. NEEDS AND OBJECTIVES OF URBAN EXPRESSWAYS

9.1 NEEDS OF URBAN EXPRESSWAYS

Metro Manila is growing rapidly with its concentration of people and economic activities. By the year 2010, population will reach to 11.4 million and transport demand, 97% of which depend on road transport, will increase from 13.6 million in 1990 to 21.6 million person trips a day. Transport condition will be progressively aggravated and an average travel speed on Metro Manila roads is estimated to decrease to 16 km/hour in 2010, even though on-going and planned road projects are completed.

At-grade road development in Metro Manila is getting increasingly difficult due mainly to road right-of-way acquisition and its associated problems, thus the development of an elevated urban expressway system fully utilizing existing road right-of-way and other public lands is an effective measure and urgently needed not only to reduce traffic congestion but also to improve the hierarchy of the urban transport system.

9.2 OBJECTICES OF MMUES

- To provide alternative transport facilities with higher service level.

  As Metro Manila grows physically and economically, transport demands increase and diversify. A segment of the demands sensitive to time value and comfort and, therefore, requiring higher services is expected to become larger. The availability of alternative high quality transport facilities would contribute to segregate the demands effectively and to improve the overall efficiency of the transport system of Metro Manila.

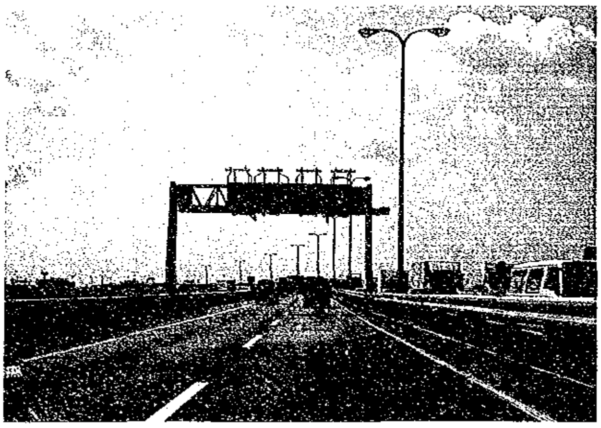
- To develop an efficient urban system

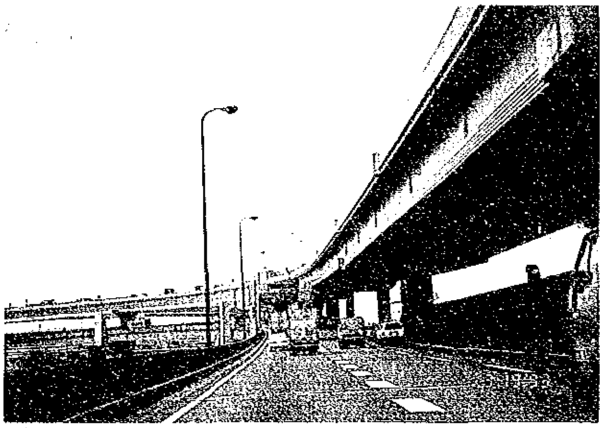
  Accessibility greatly affects landuse. This is typically seen in Metro Manila where developments make progress along major transport corridors, especially C-4. The development of an urban expressway network would, therefore, affect the future urban formation of Metro Manila, revitalizing the CBD, strengthening the interactions between the CBD and sub-centers, and encouraging new urban and suburban centers' development. An expressway system is considered as a strategic means of future development of Metro Manila.

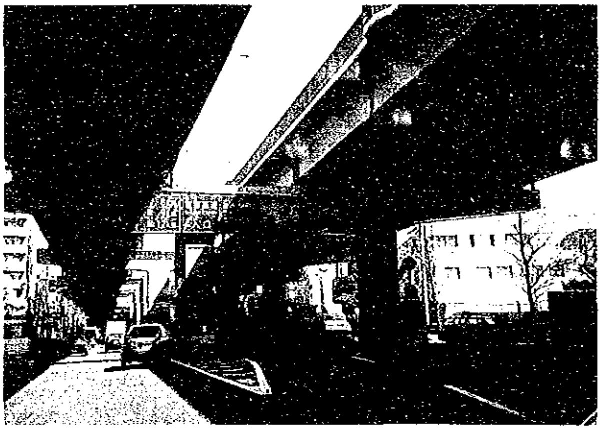
  The efficiency of infrastructure in capital cities directly affects the performance of the national economy, as well as the promotion of foreign investments for which competition among Asian cities is becoming fierce. The provision of a reliable transportation for airport, port, industrial complexes, business centers, etc., for Metro Manila and its environs is a specific objective of expressway development.

- To encourage the improvement of urban environment and amenities.

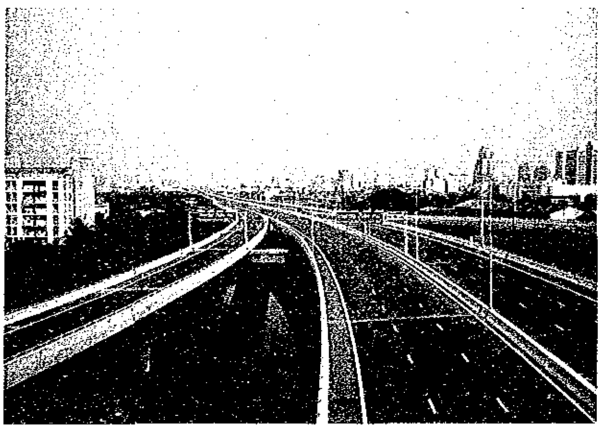
  Guidance of proper landuse and the segregation of different types and levels of traffic would contribute to the improvement of urban environment and amenities.

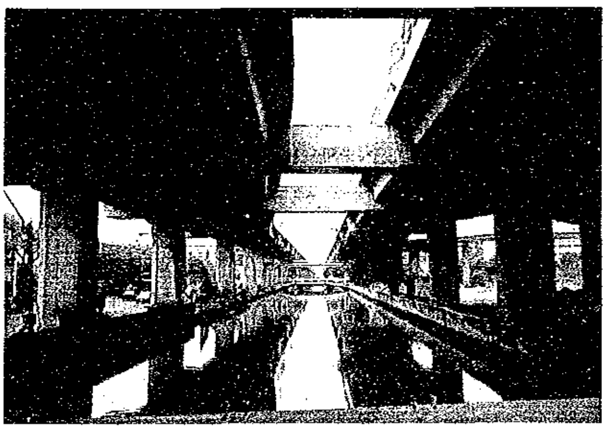






EXPRESSWAYS IN TOKYO
(Metropolitan Expressway Public Corporation , Tokyo , Japan)





BANGKOK SECOND STAGE EXPRESSWAYS

10. CANDIDATE EXPRESSWAY CORRIDORS

10.1 REQUIRED SPACE FOR BUILDING AN ELEVATED EXPRESSWAY

As shown in Table 10.1, an elevated expressway requires 35 to 40 meters right-of-way. In order to avoid extensive right-of-way acquisition, public spaces which satisfy the said requirement were the most possible candidate for an introduction of an expressway.

10.2 AVAILABLE PUBLIC SPACE

Available public spaces were as follows:

- Public roads (See Figure 10.1): Only limited public roads were considered utilizable. Most public roads are not wide enough to accommodate an expressway.
- PNR right-of-way: PNR has a 30 meter right-of-way for the most sections.
- Rivers: Possible rivers were Pasig River and San Juan River.
- Military Camps and other government owned land.

10.3 CANDIDATE EXPRESSWAY CORRIDORS

Candidate expressway corridors were identified as follows (See Figure 10.2):

Circumferential Direction	:	Along C-2, C-3, C-4, C-5 and PNR
Radial Direction in the South	:	Along R-1 extension, R-2 (new links), and South Super Highway/South Luzon Expressway
Radial Direction in the East	:	Along Pasig River/Shaw Blvd., Ortigas Ave. Extension, Santolan Road and Marcos Highway
Radial Direction in the North	:	Along Quezon Ave./Commonwealth Ave., Visayas Ave., Fairview Ave., Mindanao Ave., A. Bonifacio Ave./North Luzon Expressway, R-10 and Abad Santos/PNR

TABLE 10.1 WIDTH OF SPACE REQUIRED FOR ELEVATED EXPRESSWAY

	REQUIRED SPACE (METERS)	
	NORMAL SECTION	ON/OFF RAMP SECTION
2–way 4–lane Expressway	30.0	36.5 1/
2–way 6–lane Expressway	36.5	43.0 1/
1–way 2–lane Expressway	22.5	31.0 2/
1–way 3–lane Expressway	23.5	34.5 2/

Notes: • Minimum horizontal clearance between an expressway and building line shall be 5 meters
• At–grade street shall have at least 4 lanes
1/ Type of ramp: Center ramp
2/ Type of ramp: Side ramp

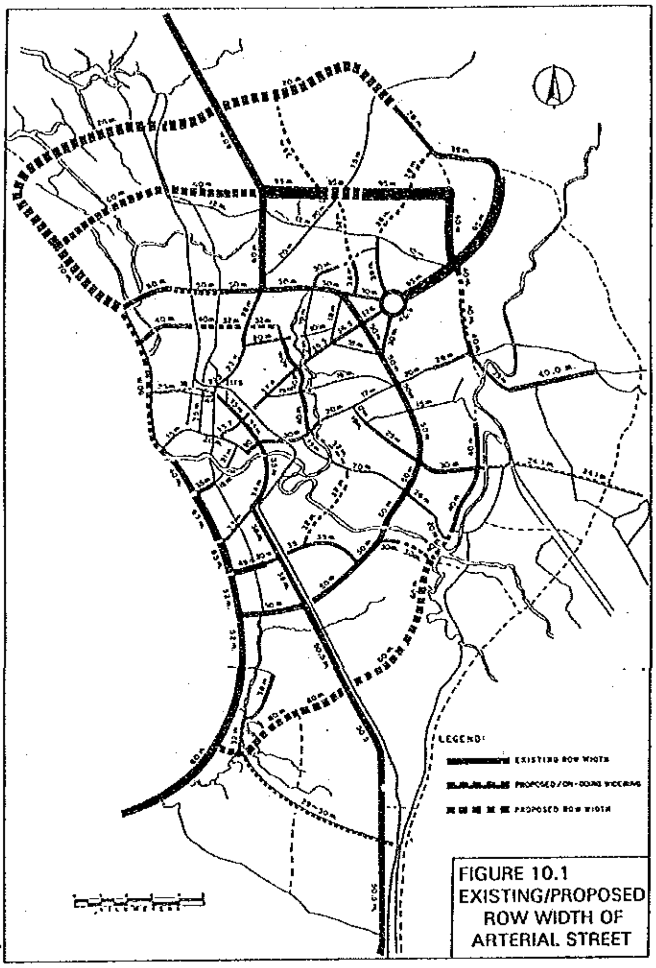


FIGURE 10.1
EXISTING/PROPOSED
ROW WIDTH OF
ARTERIAL STREET

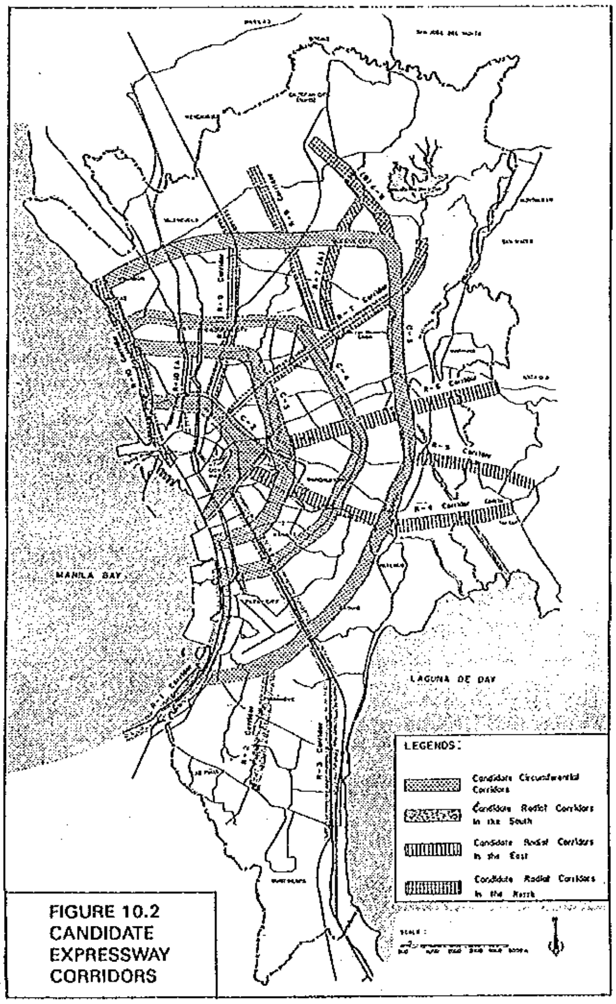


FIGURE 10.2
CANDIDATE
EXPRESSWAY
CORRIDORS

11. EVALUATION OF ALTERNATIVE EXPRESSWAY NETWORK PLANS

11.1 BASIC PRINCIPLE FOR ALTERNATIVE SCHEME FORMULATION

- Present traffic pattern coincides with a present road network which is a radial-circumferential pattern. An expressway system of radial-circumferential pattern will also be appropriate for a short-to medium-term system.

- In addition to a radial-circumferential traffic distribution pattern, traffic demand, especially private traffic in the direction of north-south will be expected to increase greatly in the future. A long-term expressway system should be provided with north-south axes in the system.

Alternative schemes are shown in Figure 11.1.

11.2 EVALUATION OF ALTERNATIVE SCHEMES

Scheme 3-B was selected as the most appropriate expressway system due to the following reasons (See Table 11.1):

- This Scheme matches better future private transport demand (the largest desire line exists between Quezon City and Makati).

- Superiority of this Scheme is obvious in the aspects of impact on at-grade roads, implementation (both structural complexity and implementation ease), traffic pollution and cost effectiveness.

- This Scheme provides the most balanced expressway network, thus traffic functionality is superior to other schemes.

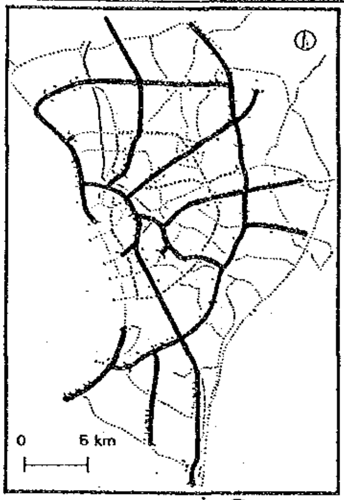
TABLE 11.1 SUMMARY OF ALTERNATIVE SCHEME EVALUATION

EVALUATION FACTORS	WEIGHT OF EVALUATION FACTORS (POINTS)	ALTERNATIVE SCHEME						
		1-A	1-B	2	3-A	3-B	4	5
LENGTH (km)	-	148	149	141	160	150	144	138
PROJECT COST (Billion Peso)	--	56.1	56.4	62.8	59.8	55.3	59.6	48.7
1. Transport	30							
1) For Private transport 1/	(15)	265 (7.5)	272 (8.0)	336 (15.0)	272 (8.0)	275 (8.0)	315 (12.5)	238 (5.0)
2) For Public transport	(5)	Good (5.0)	Good (5.0)	Fair (3.0)	Fair (3.0)	Fair (3.0)	Fair (3.0)	Fair (3.0)
3) Impact on At-grade roads 2/	(10)	1,810 (8.0)	1,800 (8.0)	1,770 (9.0)	1,770 (9.0)	1,740 (10.0)	1,930 (4.0)	1,920 (4.0)
2. Urban Development	20							
1) Vitalization of inner CBD	(10)	Good (10.0)	Good/ Fair (8.0)	Good (10.0)	Fair (6.0)	Fair (6.0)	Fair (6.0)	Fair (6.0)
2) To Meet Sub-urbanization	(10)	Good (10.0)	Good (10.0)	Fair (6.0)	Good (10.0)	Good (10.0)	Fair (6.0)	Fair (6.0)
3. Implementation	15							
1) Structural-Complexity 3/	(5)	19.5 (4.0)	25.1 (3.5)	42.5 (1.0)	17.3 (4.5)	16.4 (5.0)	40.8 (1.0)	16.1 (5.0)
2) Implementation Difficulty 4/	(10)	29.5 (8.0)	34.6 (7.0)	53.8 (3.5)	26.9 (8.5)	23.0 (9.5)	41.1 (6.0)	21.9 (10.0)
4. Environment	15							
1) Social Impact 5/	(10)	9,600 (7.5)	16,100 (1.0)	10,400 (6.5)	8,500 (8.5)	9,200 (8.0)	8,500 (8.5)	7,300 (10.0)
2) Traffic Pollution (air, noise) 6/	(5)	90.0 (2.0)	89.4 (2.0)	97.1 (0.5)	91.4 (2.0)	73.1 (5.0)	82.9 (3.5)	75.5 (5.0)
5. Cost Effectiveness 7/	10	6.6 (6.5)	7.0 (7.0)	7.6 (7.5)	8.4 (8.5)	10.1 (10.0)	3.0 (3.0)	3.8 (4.0)
6. Financial Viability 8/	10	1.9 (5.5)	1.9 (5.5)	2.4 (8.0)	1.9 (5.5)	1.9 (5.5)	2.8 (10.0)	1.7 (4.5)
Total Score	100	(74.0)	(65.0)	(70.0)	(73.5)	(80.0)	(63.5)	(62.5)
Ranking		2	5	4	3	1	6	7

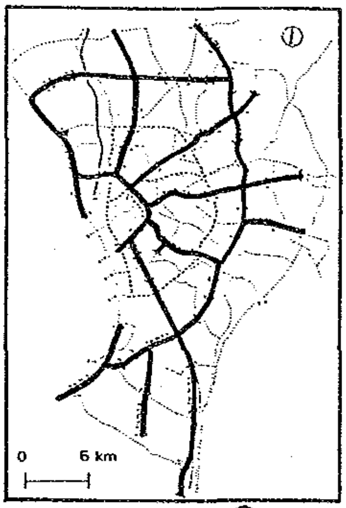
NOTES:
1/ No. of expressway users under the assumed level of P20/trip flat toll and P1.0/min/pcu time value (1,000 pcu/day)
2/ Aggregate vehicle-hours of all at-grade roads (1,000 veh-hours)
3/ Total length of expressway sections involving complex structure (km.)
4/ Total length of expressway sections where implementation difficulties are expected (km.)
5/ No. of households affected
6/ Total length of expressway sections along which land use is residential or clearance between an expressway and building line is less than 5 meters (km.)
7/ Single year direct benefits (savings of VOC and passenger time) in year 2010 (Billion Pesos)
8/ Single year toll revenue in year 2010 (P20/trip) (Billion Pesos)
* Figure in ( ) shows scored points.

FIGURE 11.1
ALTERNATIVE EXPRESSWAY
NETWORK SCHEMES

C-2 & C-5 Based Network

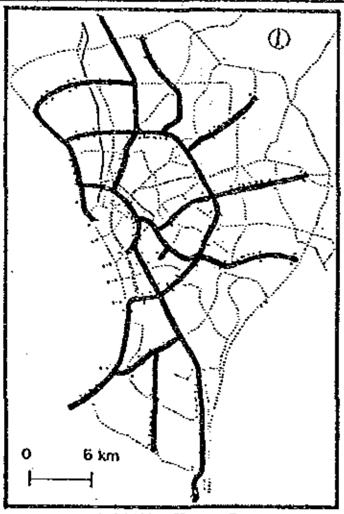


SCHEME - 1 Ⓐ
(Utilizes at grade C-2 ROW for the inner circumferential expressway)



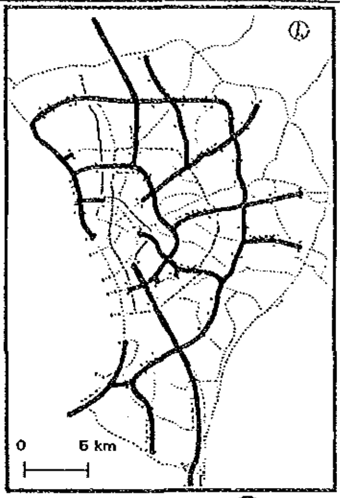
SCHEME - 1 Ⓑ
(Utilizes PNR ROW instead of at-grade C-2 ROW for the inner circumferential expressway)

C-2 & C-4 Based Network

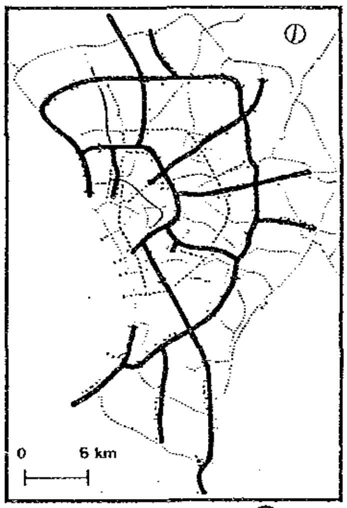


SCHEME - 2

C-3 & C-5 Based Network

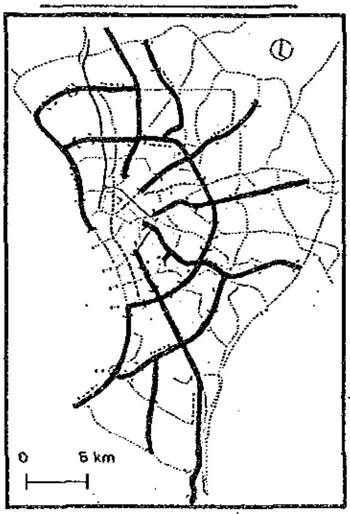


SCHEME - 3 Ⓐ
(Utilizes at-grade C-3 ROW for the inner circumferential expressway)



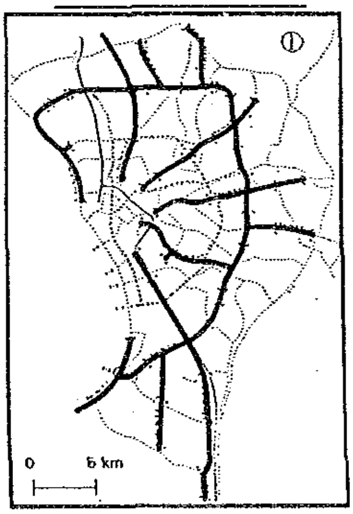
SCHEME - 3 Ⓑ
(Utilizes at-grade C-2, PNR ROW and at-grade C-3 ROW for the inner circumferential expressway)

C-4 Based Network



SCHEME - 4

C-5 Based Network



SCHEME - 5

12. RECOMMENDED EXPRESSWAY SYSTEM

Recommended system for MMUES is presented in Figure 12.1.

The configuration of MMUES is basically a circumferential and radial pattern in which two north-south transport axes are formed.

MMUES consists of two circumferential expressways (about 63 km) and 11 radial expressways (about 87 km) with a total extension of about 150 km. The inner circumferential expressway is located about 5 km in radius and the outer circumferential expressway at about 11 km in radius, both of which are linked with six radial expressways at an interval of 4 to 8 kms, thus an area of about 6 km x 6 km is surrounded by expressways. Three radial expressways extends towards Manila CBD from the inner circumferential expressway and eight radials towards outer areas of Metro Manila from the outer circumferential expressway.

Circumferential and radial expressways are connected with each other by 17 interchanges and accesses to at-grade roads are made by 61 each of on-and off-ramps.

Outline of each expressway route is shown in Table 12.1.

TABLE 12.1 OUTLINE OF EXPRESSWAY COMPRISING OF MMUES

	ROUTE NO.	ROUTE LOCATION	LENGTH (KM.)	ELEVATED OR AT-GRADE	STATUS OF AT-GRADE ROAD
Circumferential Expressways	C-3	• Inner Circumferential Expressway Starts at • Quirino Avenue Adriatico intersection and follows Quirino Ave., PNR, and San Juan River up to Aurora Blvd. From Aurora Blvd. to R-10, follows more or less alignment of at-grade C-3	17.5	• All elevated	• At-grade C-3 from A. Mabini St. to Araneta Ave. is still incomplete. Sections from A. Mabini St. to Rizal Ave. Ext. and from Rizal Ave. Ext. to Araneta Ave. is scheduled to be completed by 2000 and 1995, respectively
	C-5	• Central Circumferential Expressway • Follows more or less the alignment of at-grade C-5	45.8	• At-grade from R-1 to R-4 and from Luzon Ave. to R-10 • Elevated from R-4 to Republic Ave.	• Still incomplete except section from Pasig River to Commonwealth Ave. • Sections from R-1 to SLE and from Commonwealth Ave. to R-10 are scheduled to be completed by 2000, section from SLE to R-4 by 1995
Radial Expressways	R-1	• Along Manila Bay Coastal Line • Existing R-1 Ext. itself is utilized	–	(• Completed as at-grade road)	
	R-2	• New Link. Passes through about the center between South Luzon Expressway (SLE) and R-1 Extension	7.4	• At-grade or elevated	• No at-grade road
	R-3	• Called as Manila South Tollway (MST) • Along South Super Highway (SSH) and SLE from Quirino Ave. to Alabang	20.8	• All elevated except 1-km section near NAIA	• Both SSH and SLE are existing
	R-4	• Along Pasig River from Route C-3 to Route C-5	7.2	• All elevated	
	R-5	• Along Ortigas Ave. Ext. from at-grade C-5 to at-grade C-6	5.3	• All elevated	• Ortigas Ave. Ext. is being widened and completed by 1995
	R-6	• Along Santolan Road and Marcos Highway from Route C-3 to Sumulong Highway	12.0	• All elevated	• Santolan Road has to be widened
	R-7	• Along Quezon Ave. and Commonwealth Ave. from Welcome Rotonda to Capitol Hills	12.4	• Elevated from Welcome Rotonda to Quezon Memorial Circle • Quezon Memorial Circle be underpassed • At-grade along Commonwealth Ave.	• Both Quezon Ave. and Commonwealth Ave. existing with wide ROW
	R-8	• Along Mindanao Ave. from at-grade C-5 to at-grade C-6	4.7	• At-grade or elevated	• Mindanao Ave. between C-5 and C-6 is still missing and to be completed by 2000
	R-9	• Along A. Bonifacio Ave. and North Luzon Expressway from Route C-3 to about 0.5 km north of toll plaza	3.8	• All elevated	• Both A. Bonifacio and NLE existing
	R-10	• Along at-grade R-10 from Moriones Ave. to at-grade C-5	8.6	• All elevated	• 25-m portion of 50-m ROW completed • Ultimate stage will be completed by 2010
	R-10 A	• Along Abad Santos Ave. and PNR North Line from at-grade C-1 to at-grade C-3	4.0	• All elevated	• Abad Santos Ave. is existing
		TOTAL	149.5		

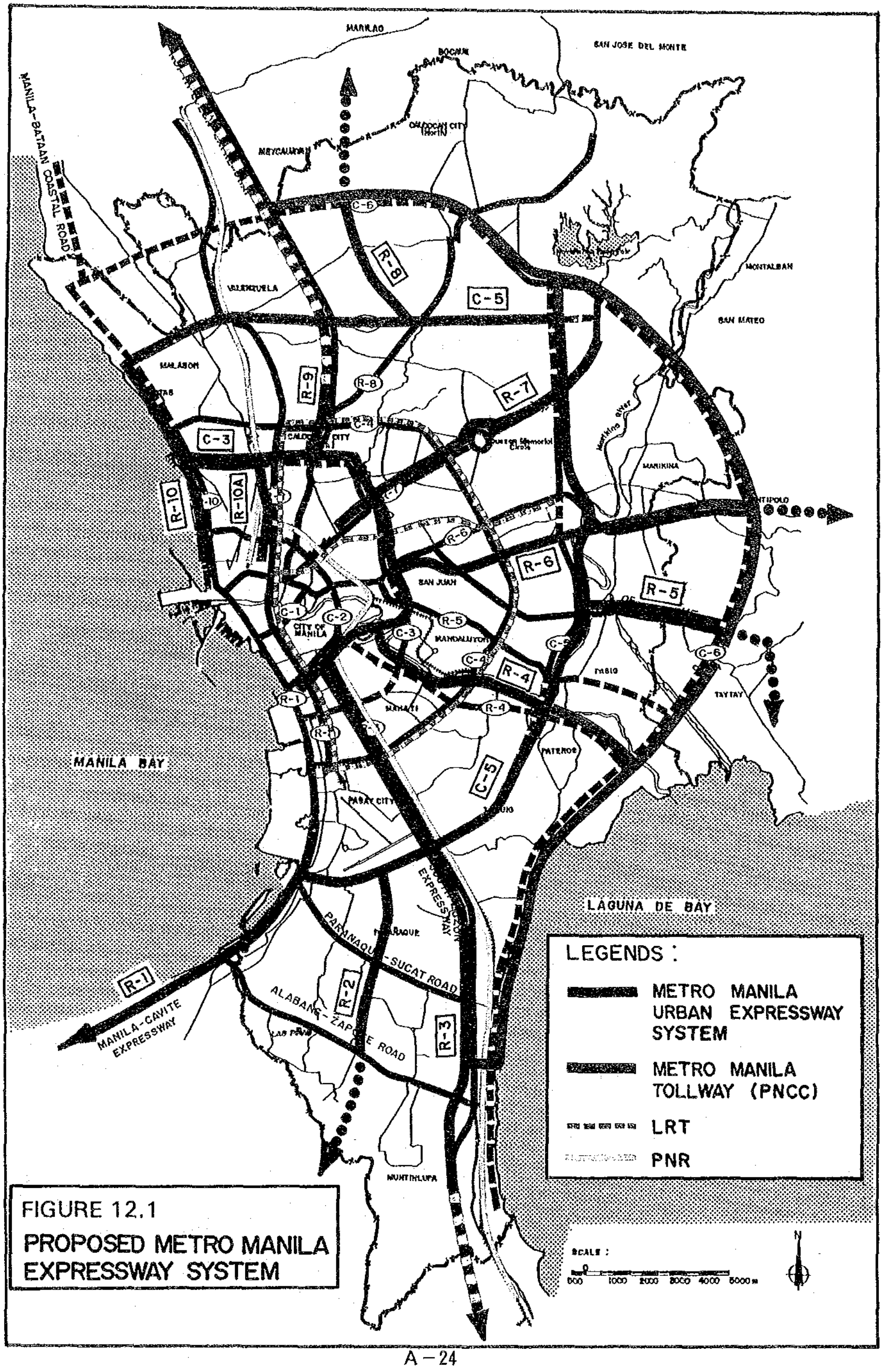


FIGURE 12.1

PROPOSED METRO MANILA EXPRESSWAY SYSTEM

13. ENGINEERING STANDARDS

Geometric design standards are presented in Table 13.1 and standard cross sections are shown in Figure 13.1. Two major critical issues for establishing geometric design standards were as follows:

Design Speed

Design speed of 60 km per hour for expressways inside C-4 and 80 km per hour for expressways outside C-4 was recommended.

As the areas inside C-4 are highly developed, extensive ROW acquisition is quite difficult. Therefore, an expressway alignment will be so selected as to maximumly utilize existing public spaces such as existing at-grade major roads and rivers which control an expressway alignment to a great extent. At-grade major roads inside C-4 were designed with design speed of 60 km. per hour, thus it is practical to select design speed of 60 km. per hour for expressways inside C-4.

For expressways outside C-4, higher design standards than those inside C-4 are required due to the following viewpoints:

- Some of them will be, in future, linked with an inter-city expressway which has design speed of 80 to 100 km per hour.
- To reduce traffic burden of C-4, expressways outside C-4 should be planned with high design standards so that traffic on C-4 is attracted to expressways.
- To strengthen accessibility to and transport interlinkage among urban centers growing along and outside C-4, expressways should be planned with high design standards.

Outer Shoulder Width

Outer shoulder width of 2.0 meter throughout an expressway was recommended due to the following reasons:

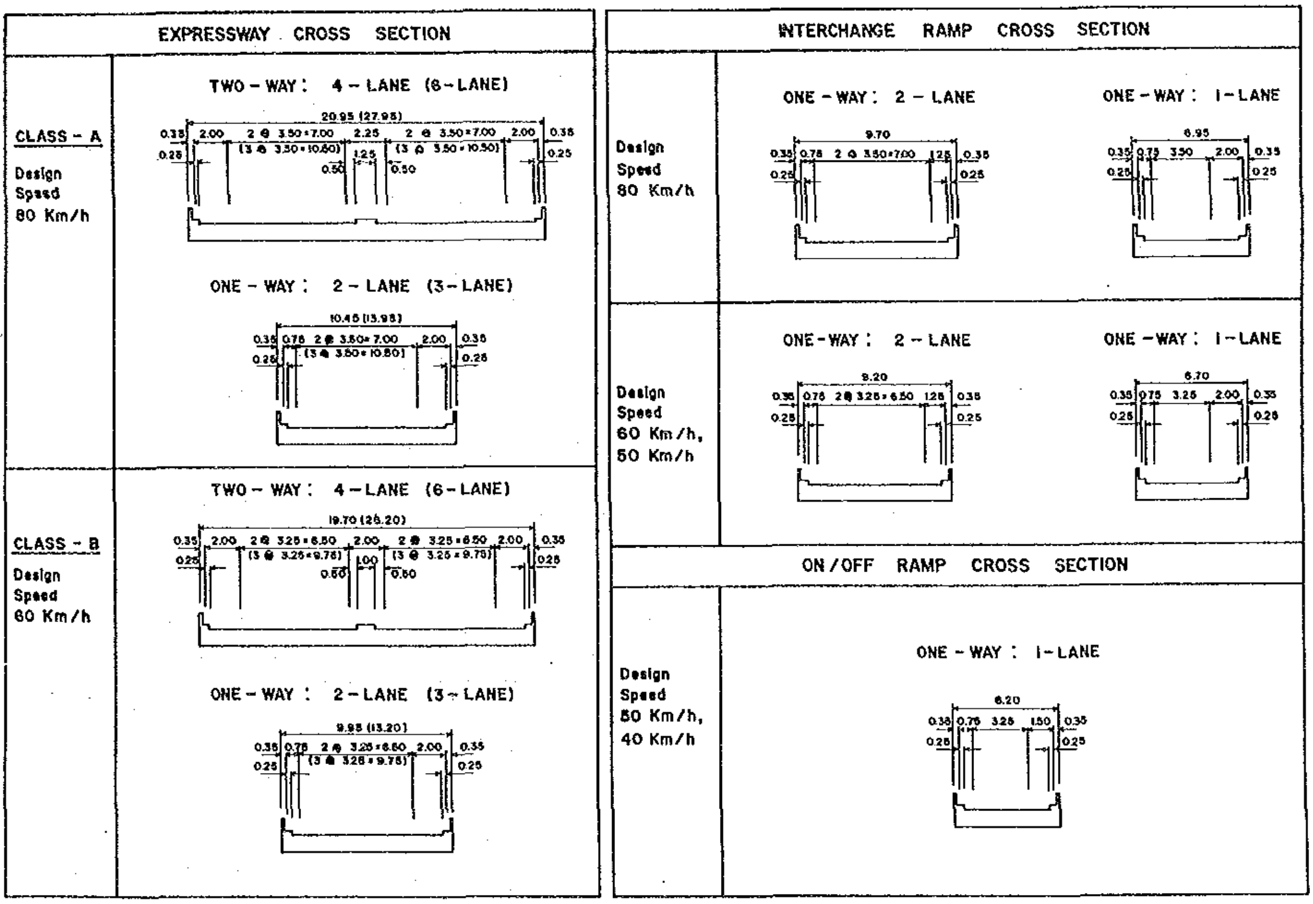
Traffic demand for expressways in Metro Manila is high, thus all traffic lanes will be in use for the most of the time of a day. Where shoulder width is not sufficient, a stopped vehicle will disrupt traffic not only on the occupied lane but on all lanes in that direction. There are many obsolete vehicles which are still in use in Metro Manila. It is expected that a rate of vehicle breakdown on an expressway is high, wider outer shoulder width is desired to be provided throughout an expressway.

TABLE 13.1 GEOMETRIC DESIGN STANDARDS FOR AN EXPRESSWAY

DESCRIPTION		UNIT	CLASS–A (OUTSIDE EDSA)	CLASS–B (INSIDE EDSA)
Design Speed		km/h	80	60
Lane Width		m	3.50	3.25
Inner Shoulder Width		m	0.75	0.75
Outer Shoulder Width		m	2.00	2.00
Median Width		m	2.25	2.00
Median Island Width		m	1.25	1.00
Horizontal Alignment	Minimum Radius	m	280 (230)	150 (130)
	Minimum Curve Length	m	140	100
	Maximum Superelevation	%	10.0	10.0
	Minimum Transition Length	m	70	50
Vertical Alignment	Maximum Gradient	%	4.0	5.0
	Minimum Radius of Vertical Curve (Crest)	m	5,000 (3,000)	2,000 (1,400)
	Minimum Radius of Vertical Curve (Sag)	m	3,000 (2,000)	1,500 (1,000)
	Minimum Vertical Curve Length	m	70	50
Minimum Stopping Sight Distance		m	140 (110)	85 (75)
Pavement Cross Fall		%	2.0	2.0
Composite Gradient		%	10.5	10.5
Vertical Clearance		m	4.7	4.7

Note: The figure in ( ) shows absolute minimum value to be used only when the conditions necessitate.

FIGURE 13.1 PROPOSED STANDARD CROSS SECTIONS



14. STAGE DEVELOPMENT PLAN

14.1 STAGE DEVELOPMENT ALTERNATIVES

Basic principle adopted for developing alternatives is as follows:

- Inner circumferential expressway, i.e. Route C-3 and other spine radial expressways should be firstly constructed to form inner transport core, so as to mitigate rapidly worsening traffic situation inside EDSA.

Based on the above principle, three (3) alternatives were studied as follow. (See Figure 14.1):

Alternative-A: Traffic Demand Oriented Plan

Alternative-B: Balanced Area Development Oriented Plan

Alternative-C: Makati CBD Access Improvement Oriented Plan

Alternative-A was recommended due to the following reasons:

- To implement the First Stage without failure is the most important matter for completion of total system of MMUES. The First Stage expressways, therefore, must include expressways which attract higher traffic, and are easier in implementation.
- Alternative-A satisfies these conditions.
- The First Stage of Alternative-B includes an expressway of which implementation is expected to be very difficult.
- Alternative-C will surely improve the accessibility to Makati CBD, however, that to other urban centers is rather neglected.

14.2 PROJECT COST BY STAGE

Project cost of MMUES was estimted at about 55 billions pesos. Project cost by stage is as follows:

PROJECT COST BY STAGE

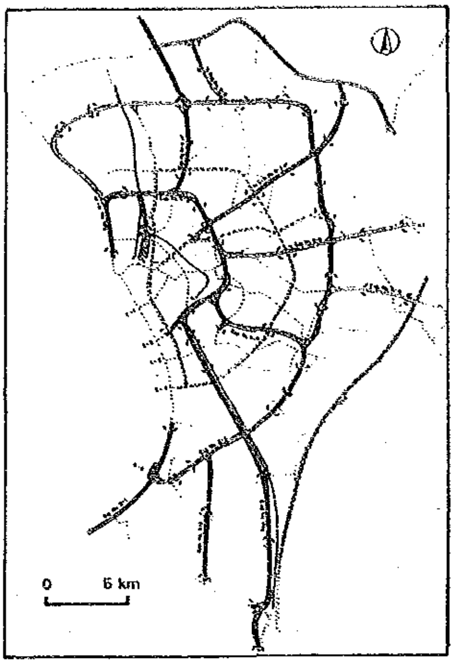
Unit: Million Pesos at March 1992 Prices

STAGE	CIVIL WORK	ROW	TOTAL
First Stage	20,744	2,639	23,383
Second Stage	20,468	3,314	23,782
Third Stage	7,375	734	8,109
TOTAL	48,587	6,687	55,274

FIGURE 14.1
ALTERNATIVE STAGE DEVELOPMENT PLANS

ALTERNATIVE - A

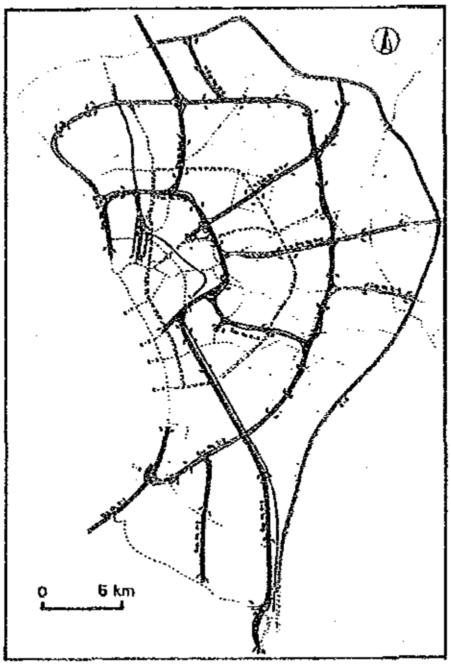
* TRANSPORT DEMAND ORIENTED PLAN



FIRST STAGE	-	60.0 km.
SECOND STAGE	-	66.1 km.
THIRD STAGE	-	69.8 km.
TOTAL		195.9 km.

ALTERNATIVE - B

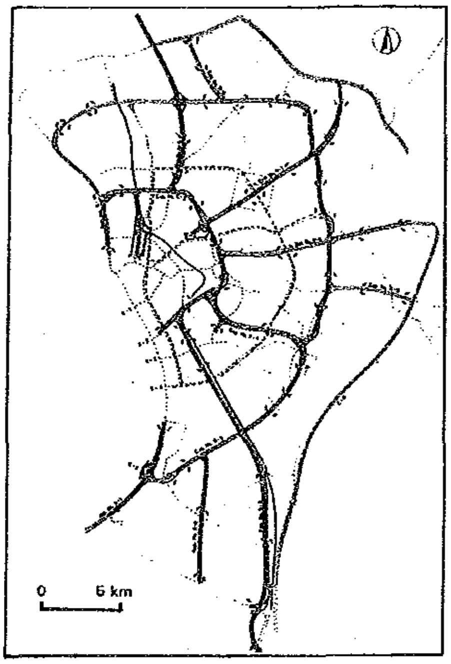
* BALANCED AREA DEVELOPMENT PLAN



FIRST STAGE	-	59.6 km.
SECOND STAGE	-	66.5 km.
THIRD STAGE	-	69.8 km.
TOTAL		195.9 km.

ALTERNATIVE - C

* MAKATI CBD ACCESS IMPROVEMENT PLAN



FIRST STAGE	-	63.4 km.
SECOND STAGE	-	62.7 km.
THIRD STAGE	-	69.8 km.
TOTAL		195.9 km.

15. TRAFFIC IMPACT

15.1 TOLL RATE VS. EXPRESSWAY TRAFFIC VOLUME

- The dominant factors which determine the expressway traffic when toll is charged are (1) time value of car users, (2) traffic congestion level on surface roads, and (3) level of toll. Particularly, the first two factors are critical than the third one.

- The estimated overall private transport demand in terms of pcu for years 1990, 2000, and 2010 are 1.5, 2.7, and 3.7 millions a day, respectively. The maximum potential expressway traffic (under toll free situation) is roughly 15 to 20% of the above total traffic.

- Although there is potential demand (under toll-free situation) for expressways, e.g., 219 thousand in 1990 under Stage 1 network, when toll is charged, there will be little actualized expressway traffic. With P10 toll, there will only be 32 thousand users. However, by year 2010, potential expressway demand will be doubled and actualized expressway traffic will increase by more than five times. (See Table 15.1).

- If the traffic situation worsens, e.g., either traffic capacities decrease due to ineffective traffic management or network deficiencies or traffic demand increases due to change in assumed private car utilization behavior, etc., the number of expressway users increase significantly.

15.2 EXPRESSWAY TRAFFIC VOLUME ON THE NETWORK

For year 2010, (I + II) network would be well utilized which would require the full four-lane structure for most of the sections (See Figure 15.1).

15.3 IMPACT OF EXPRESSWAY ON AT-GRADE ROADS

- The impacts are significant on the roads in the corridors where expressways are built, particularly along South Super Highway/South Luzon Expressway, C-2, Quezon Avenue and southern sections of C-5. Other radial roads such as A. Bonifacio, E. Rodriguez, Shaw Blvd. as well as Buendia would also be relieved.

- EDSA traffic would not be lessened along most of the sections. This is mainly because, a) trip destinations are located along EDSA and b) the local traffic alongside EDSA would increase considerably.

TABLE 15.1 ESTIMATED NO. OF EXPRESSWAY USERS

000 PCU

ASSUMED TIME VALUE (P/MIN/PCU)	ASSUMED TOLL (P/TRIP)	STAGE I			STAGE (I+II)		STAGE (I+II+III)
		(1990)	2000	2010	2000	2010	2010
	Free	(222)	351	418	563	649	751
P0.5	P10	(31)	98	154	152	245	269
	P20	(2)	46	96	68	148	165
	P30	(0)	27	52	34	81	102
P0.7	P10	(59)	113	194	187	303	324
	P20	(11)	79	126	107	195	214
	P30	(0.5)	39	94	60	140	154
P1.0	P10	(84)	134	236	236	348	374
	P20	(30)	99	158	149	245	269
	P30	(9)	75	120	102	190	205
P1.5	P10	(105)	174	267	271	412	442
	P20	(65)	116	202	195	308	334
	P30	(30)	98	160	149	246	268

FIGURE 15.1 EXPRESSWAY AND AT-GRADE TRAFFIC VOLUME

Assumed Situation : Year 2010, Stage (I + II), Toll ₱20 Flat

16. ENVIRONMENTAL IMPACT

Air Quality

An expressway network will have a favorable impact on air pollution by speeding up traffic flow, improving fuel efficiency, and reducing vehicular emission rates. It is estimated that an average travel speed of vehicles in year 2010 will be about 16 km/hour under "without expressways case" which will be improved to about 19.6 km/hour "with expressways case". It is roughly estimated based on data in Japan that this improvement will contribute to decrease in CO and NOx emission rates by about 20% and about 6%, respectively.

Noise

- Relatively high levels of noise will occur during construction, and these may exceed the 65 db and 75 db acceptable noise levels set for residential and commercial areas, respectively. Bore piling should be used instead of driven piles in noise-sensitive areas.

- During operation stage, adjacent areas to an expressway would suffer noise problem, therefore, necessary measures such as installation of noise barriers, control of overloaded trucks, etc. should be implemented.

Vibration

- The project consists mostly of viaduct structures and requires minimal earth works, therefore, heavy equipment will not be extensively used. Adverse effects by vibration during construction stage will be minimal. During operation stage, traffic-induced vibration is transmitted to hard bearing strata which support expressway structures, therefore, adverse effects by vibration will not be expected.

Relocation and ROW Acquisition

- About 5,500 squatter families mostly along PNR, San Juan River and Pasig River will be affected. Relocation of them is a significant social impact which can be traumatic for those affected. However, areas along the said areas are considered danger zones, and are not covered by an existing moratorium on squatter relocation. Squatter removal from these areas will, overall, be beneficial in terms of improving urban amenity. Relocation of affected squatters must be done in accordance with existing laws.

- ROW acquisition should be made at a reasonable price as possible. Other possible measures to arrange comparable relocation site or such should be also taken.

17. IMPACT ON URBAN DEVELOPMENT/LANDUSE

- First Stage Expressways, which is intended to meet present private transport needs directly, would not change the landuse greatly but strengthen the following activeness and urban development trends:

  - CBD function, especially of Makati and, to lesser extent, of Malate and inner core areas

  - Suburbanization towards the south and north-east where Metro Manila should extend

  - Port/Airport related activities

- Second Stage Component, on the other hand, would affect landuse and urban development significantly if adequate landuse planning and control measures are associated. Possible favorable impacts include:

  - Creation of new strong urban centers outside EDSA, especially along C-5. This includes possible development of military bases and publicly owned lands.

  - Integration of all major urban centers to each other and with new urban areas via the expressway network, with a north-south ladder pattern rather than a radial-circumferential pattern, would encourage urban development along the Guadalupe Plateau in compliance with the overall urban development strategy of MMA.

  - A new branch expressway route towards the south is expected to play a great role in reorganizing the existing chaotic landuse, enhancing optimum urban development, and linking the CALABARZON area effectively.

  Negative impacts of expressways which, however, depend upon how they are to be dealt with should also be taken into account, such as:

  - Construction of expressway structures in the existing roadways reduce their traffic capacities, thus affects accessibilities by vehicle to/from the roadside establishments/facilities. Without due consideration, this will not only adversely affect socio-economic activities in the influence area but also reduce the overall efficiency of the road network. Therefore, expressways must be so designed that the existing number of lanes of an at-grade road is maintained as much as possible.

18. ECONOMIC AND FINANCIAL EVALUATION

To examine a range of economic and financial viability with particular regard to stage development and toll level, the average annual cost was compared with benefits or revenue of the project.

Economic Viability

a) The economic impact of Stage I alone is limited but with the addition of Stage II, the benefits will increase sharply.

b) The first year benefits of Stage 1 exceed the annual average project cost before 1995 for toll free situation but only in early 2000 for P10 toll situation. It seems that the first stage alone does not generate sufficient economic benefits for subsequent years.

Financial Viability

a) From the financial aspect, the most profitable solution is to charge a toll of P20 for the first stage and P30 for the second stage. However, both stages would not be able to generate sufficient revenue to cover the project.

b) The best option from the financial aspect, however, would only generate minimal economic benefit.

Combined Evaluation

- Under the present level of passengers' time value and traffic congestion of at-grade roads, economic and financial viability is in the relation of trade off. Optimum solution from the economic viewpoint does not comply to that from financial aspect or vice versa.

- The project is economically feasible, especially when a toll is charged P10 or below for the First Stage and P20 or below for the Second Stage. The timing of opening of the First Stage and the Second Stage will be no earlier than year 2000 and year 2010, respectively.

- The project is difficult to be justified from the financial viewpoint, unless long-term soft loans are secured.

- The option from the economic aspect (P10 for the First Stage and P20 for the Second Stage) would generate toll revenue 20 to 30% less than that of the most financially profitable option (P20 for the First Stage and P30 for the Second Stage). Therefore, toll rates and implementation timing must be decided in due consideration of both economic and financial aspects.

TABLE 18.1 AVERAGE ANNUAL COST OF THE PROJECT

	CONSTRUCTION COST (P/BILLION)	AVE. ANNUAL COST (P/BILLION)[2]
Stage I	23.38	3.73
Stage II	23.78	3.80
Stage III [1]	8.11	1.30
Total	55.27	8.83

[1] Excluding the cost of Metro Manila Toll Road (PNCC franchised toll road) along C6.

[2] Excluding maintenance and operation cost

TABLE 18.3 AVERAGE ANNUAL COST OF THE PROJECT

	CONSTRUCTION COST (P/BILLION)	AVE. ANNUAL COST (P/BILLION)[2]
Stage I	23.38	1.52
Stage II	23.78	1.55
Stage III [1]	8.11	0.53
Total	55.27	3.60

[1] Excluding the cost of Metro Manila Toll Road.

[2] Excluding maintenance and operation cost

TABLE 18.2
ESTIMATED ECONOMIC BENEFITS UNDER DEVELOPMENT STAGE

(₱ million/day)

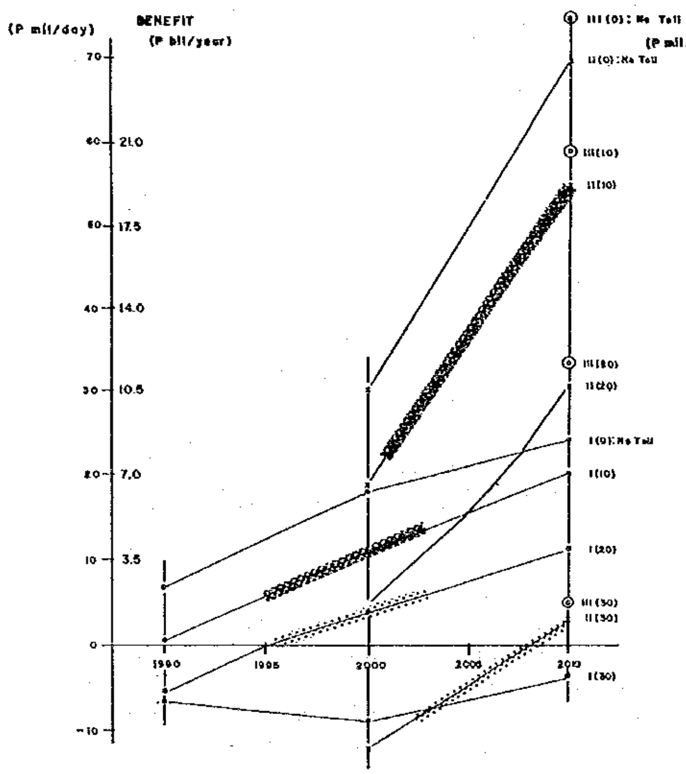
ASSUMED TOLL (P/TRIP)	STAGE (I)			STAGE (I+II)		STAGE (I+II+III)
	(1990)	2000	2010	2000	2010	2010
Free	(6.61)	18.24	24.44	30.47	68.92	77.05
₱10	(0.68)	11.11	21.11	18.59	55.23	58.99
₱20	(−5.41)	4.39	11.46	4.59	31.64	33.12
₱30	(−6.43)	− 8.1	−2.88	− 11.68	4.02	5.55

TABLE 18.4
ESTIMATED TOLL REVENUE BY DEVELOPMENT STAGE

(₱ million/day)

ASSUMED TOLL (P/TRIP)	STAGE (I)			STAGE (I+II)		STAGE (I+II+III)
	(1990)	2000	2010	2000	2010	2010
₱10	(0.31)	1.13	2.36	1.87	3.48	3.74
₱20	(0.03)	1.57	3.16	2.13	4.90	5.37
₱30	(0)	1.16	3.60	1.79	5.68	6.14
₱40	(****)	****	3.94	****	6.04	6.55

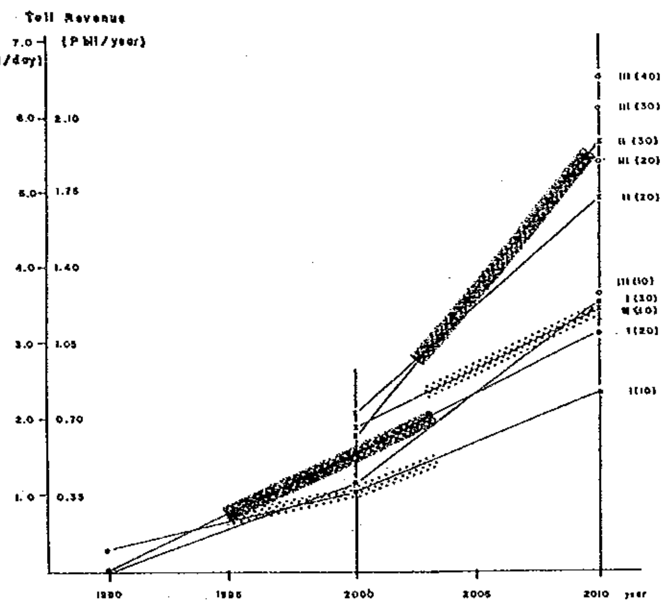
FIGURE 18.1
ESTIMATED ECONOMIC BENEFITS BY DEVELOPMENT STAGE



LEGEND:

I : Stage I
II : Stage I+II
III : Stage I+II+III
( ) : Toll Peso Flat
: Prefered alternative from economic viewpoint
: Prefered alternative from financial viewpoint

FIGURE 18.2
ESTIMATED TOLL REVENUE BY DEVELOPMENT STATE (₱mil/day)



LEGEND:

I : Stage I
II : Stage I+II
III : Stage I+II+III
( ) : Toll Peso Flat
: Prefered alternative from financial viewpoint
: Prefered alternative from economic viewpoint

19. EXPRESSWAY OPERATION AND MAINTENANCE

19.1 TOLL RATE AND COLLECTION SYSTEM

Although toll rate needs to be charged according to trip length on expressways, flat rate system is usually adopted for urban expressways. For MMUES, flat rate system is applied due to the following reasons:

- To minimize stoppage at toll booths to handle heavy traffic effectively
- To attract traffic with longer trip length to encourage functional complement between expressways and surface street
- To lessen provision of toll collection facilities. Under flat rate system, toll booths can be provided only at entrance ramps.

In order to reduce service time at toll booths, vehicle types should be farther grouped, say, into large vehicle and ordinary vehicle. Issuance of season tickets is also considered effective for reduction of service time.

Toll collection will be made manually. Number of tickets sold will be compared with actual vehicle traffic volume counted with automatic traffic counter.

19.2 TRAFFIC MANAGEMENT

Traffic management for expressways includes the following activities.

Traffic Control: Traffic control for expressways to provide users with smooth and safe traffic including enforcement of speed limit, enforcement of restrictions on vehicle type and weight limit and regulation of traffic entry at ramps.

Accident Management: Accidents on expressways are to be handled effectively to minimize the disturbance of traffic flow.

Traffic Information System: For effective control of traffic flow, traffic information needs to be properly collected and processed.

19.3 PUBLIC TRANSPORTATION ON EXPRESSWAYS

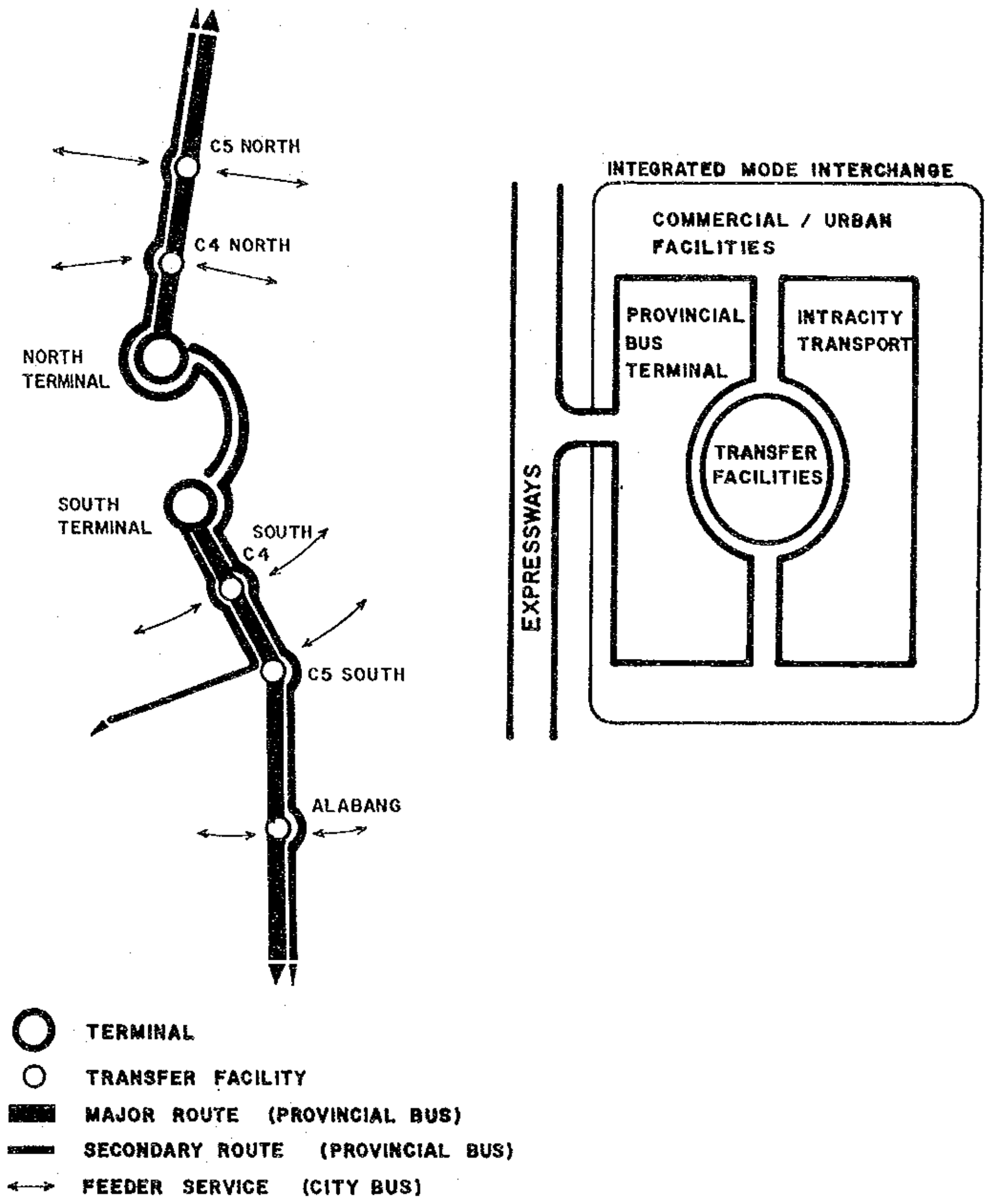
Potential public transport demand exists in the area of provincial buses and urban buses such as buses similar to Love Bus and expressway buses which are non-stop from original to destination.

Present jeepneys should be restricted from using expressways because that jeepneys are suitable more for demand with short trip and their physical standards do not comply with high standard roadways.

19.4 EXPRESSWAY MAINTENANCE

Maintenance of expressway facilities is quite important to keep the facilities in good condition to ensure safety and comfort of users and to prolong life of facilities. Proper maintenance organization and budgeting system should be established from the initial stage of expressway operation.

FIGURE 19.1 CONCEPT OF INTEGRATED PROVINCIAL BUS TERMINAL



20. OVERALL IMPLEMENTATION SCHEDULE

20.1 IMPLEMENTATION SCENARIO

DPWH is currently placing high priority on opening up of an at-grade C-5. C-5 segments and its related roads are under various implementation stages. Three (3) segments of C-5 and a section of R-10 from C-4 to C-5 are proposed to be implemented by BOT scheme, which means that these will be constructed as access controlled toll roads. If so constructed, all of these can constitute parts of MMUES.

All these segments proposed for BOT projects are included in the Second or Third stage of MMUES, however, as soon as BOT agreement is reached, these can be implemented simultaneously or even ahead of the First Stage of MMUES.

In view of the above, two implementation scenarios were prepared as follows:

Scenario-1: Implementation by the Government

All MMUES projects will be implemented by the Government through DPWH or a new body attached to the Government in accordance with proposed MMUES stages.

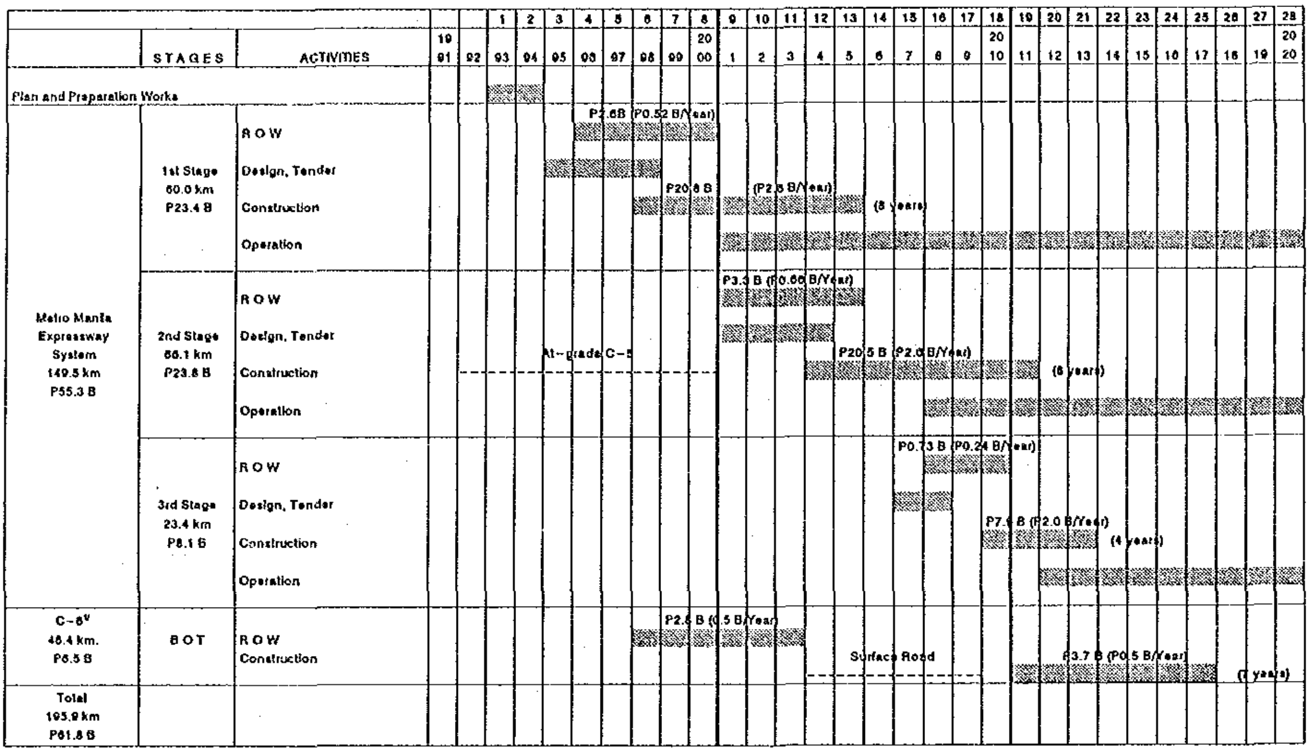
Scenario-2: Implementation by the Government and the private sector

This scenario assumes that projects proposed for BOT scheme are implemented by private sector. MMUES projects are implemented by the Government or a new body attached to the Government.

20.2 IMPLEMENTATION SCHEDULE

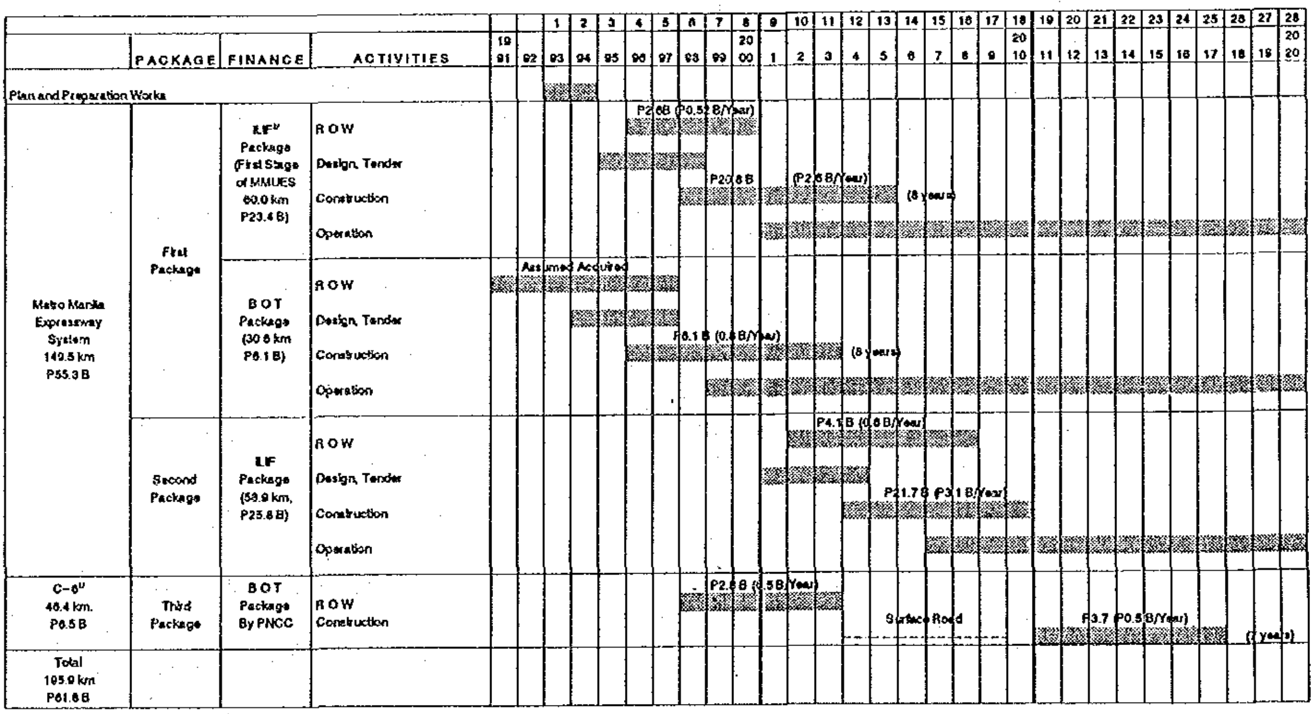
Implementation schedule for Scenario-1 and Scenario-2 is shown in Figure 20.1 and Figure 20.2, respectively.

FIGURE 20.1 OVERALL IMPLEMENTATION SCHEDULE (SCENARIO - 1)



Note: [1] Metro Manila Tollway (PNCC)

FIGURE 20.2 OVERALL IMPLEMENTATION SCHEDULE (SCENARIO - 2)



Note: [1] Metro Manila Tollway (PNCC)
[2] ILF: International Lending Institution Finance