REPUBLIC OF THE PHILIPPINES
MINISTRY OF PUBLIC WORKS & HIGHWAYS

FEASIBILITY STUDY FOR THE METRO MANILA OUTER MAJOR ROADS PROJECT (NORTHERN PACKAGE)

FINAL REPORT
(MAIN VOLUME)

JUNE, 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

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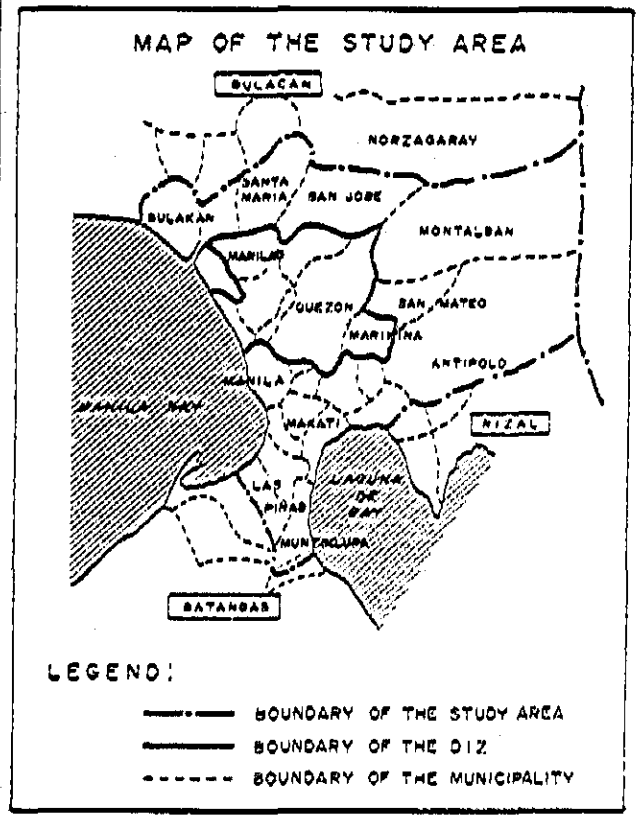
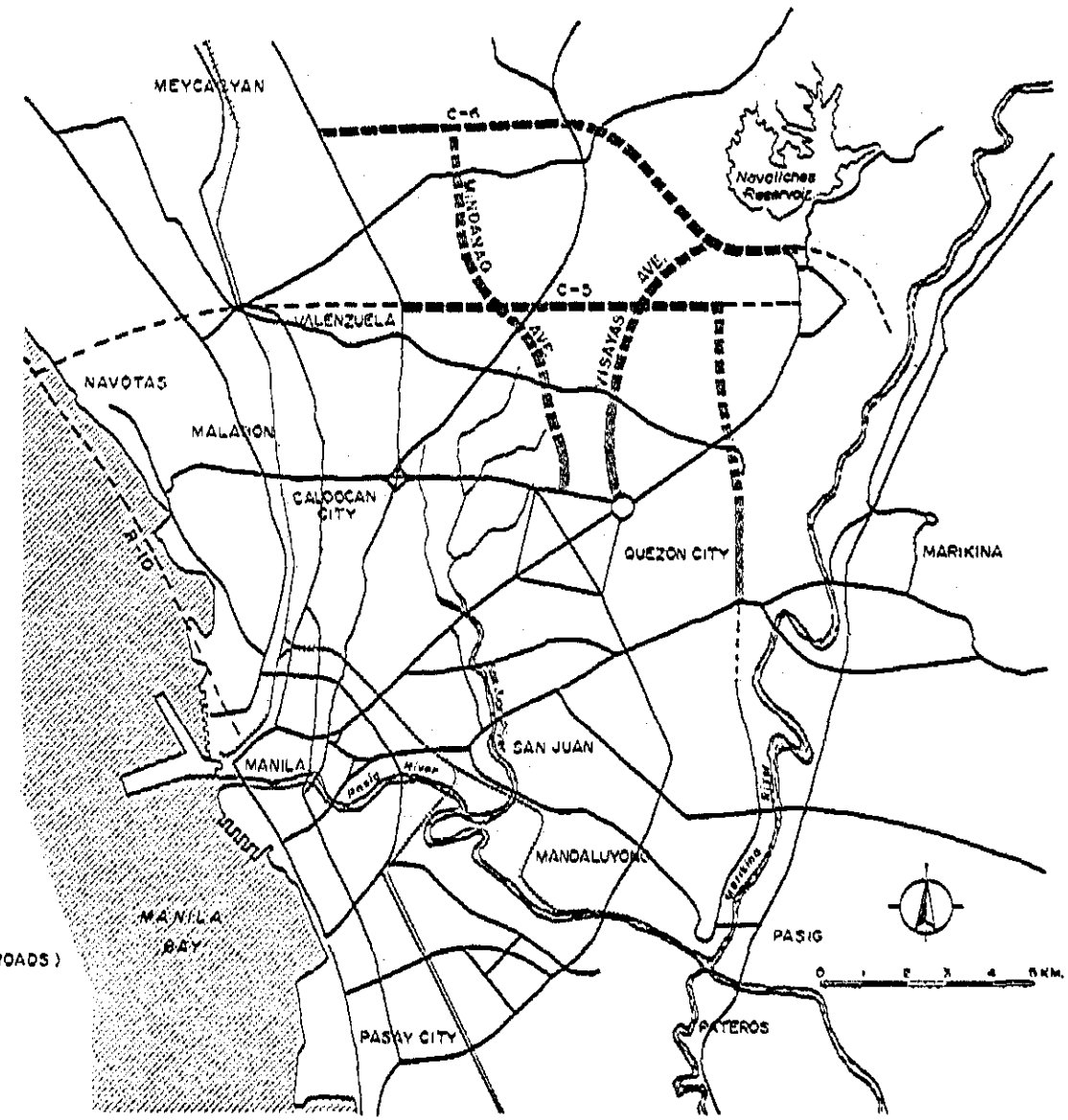
PROJECT LOCATION MAP





LEGEND:

- PROJECT ROADS (NEW CONSTRUCTION)
- PROJECT ROADS (IMPROVEMENT OF EXISTING ROADS)
- OTHER EXPECTED TRUNK ROADS
- EXISTING ROADS

PREFACE

In response to the request of the Government of the Republic of the Philippines, the Government of Japan decided to conduct a feasibility study on the Metro Manila Outer Major Roads Project (Northern Package) and entrusted it to the Japan International Cooperation Agency (JICA). The JICA sent to the Philippines a survey team headed by Mr. Hirokazu Ito from June 1982 to March 1983.

The team had discussions with the officials concerned of the Government of the Philippines on the Project and conducted a field survey in the Philippines. After the team returned to Japan, further studies were made and the present report has been prepared.

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

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

June, 1983

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

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CHAPTER 6 SELECTION OF OPTIMUM ROUTES AND FORMULATION OF ALTERNATIVE PLANS

ABBREVIATIONS

A	AASHTO:	American Association of State Highway and Transportation Official
	AACE:	American Association of Civil Engineer
C	CBD:	Central Business District
	C.B.R.:	California Bearing Ratio
	CIF:	Capital Investment Folio
	CO:	Carbon Monoxide
D	db:	decibel
	DIZ:	Direct Influence Zone
E	EDSA:	Epifanio de los Santos Avenue
	EMK:	Equivalent Maintenance Kilometer
G	GDP:	Gross Domestic Product
	GNP:	Gross National Product
	GOJ:	Government of Japan
	GOP:	Government of the Philippines
	GRDP:	Gross Regional Domestic Product
I	IBRD:	International Bank for Reconstruction and Development
M	MHS:	Ministry of Human Settlements
	MMC:	Metro Manila Commission
	MMETROPLAN:	Metro Manila Transport, Land Use and Development Planning Project
	MMUTIP:	Metro Manila Urban Transportation Investment Project
	MNDR:	Manila North Diversion Road (= MNE)
	MNE:	Manila North Expressway
	MOE:	Ministry of Energy
	MOTC:	Ministry of Transportation and Communication
	MWSS:	Metro Manila Waterworks and Sewerage System

N	NCR:	National Capital Region
	NCSO:	National Census and Statistics Office
	NEDA:	National Economic Development Authority
O	OECD:	Organization of Economic Cooperation and Development
P	PCC:	Portland Cement Concrete
	PCEF:	Passenger Car Equivalent Factor
	PCU:	Passenger Car Unit
	psi:	pounds per square inch
	PT:	person trip
	PUV:	Public Utility Vehicle
R	RDFP:	Regional Development Framework Plan
	ROW:	Right-of-Way
S	SO_2:	Sulfur Dioxide
	Sq.M:	Square Meter
T	TEAM:	Traffic Engineering and Management
U	UNDP:	United Nation Development Project
	URPO:	Urban Road Projects Office
	UTSMMA:	Urban Transportations Study for Metropolitan Manila
V	V/C Ratio:	Volume/Capacity ratio

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SUMMARY AND RECOMMENDATIONS

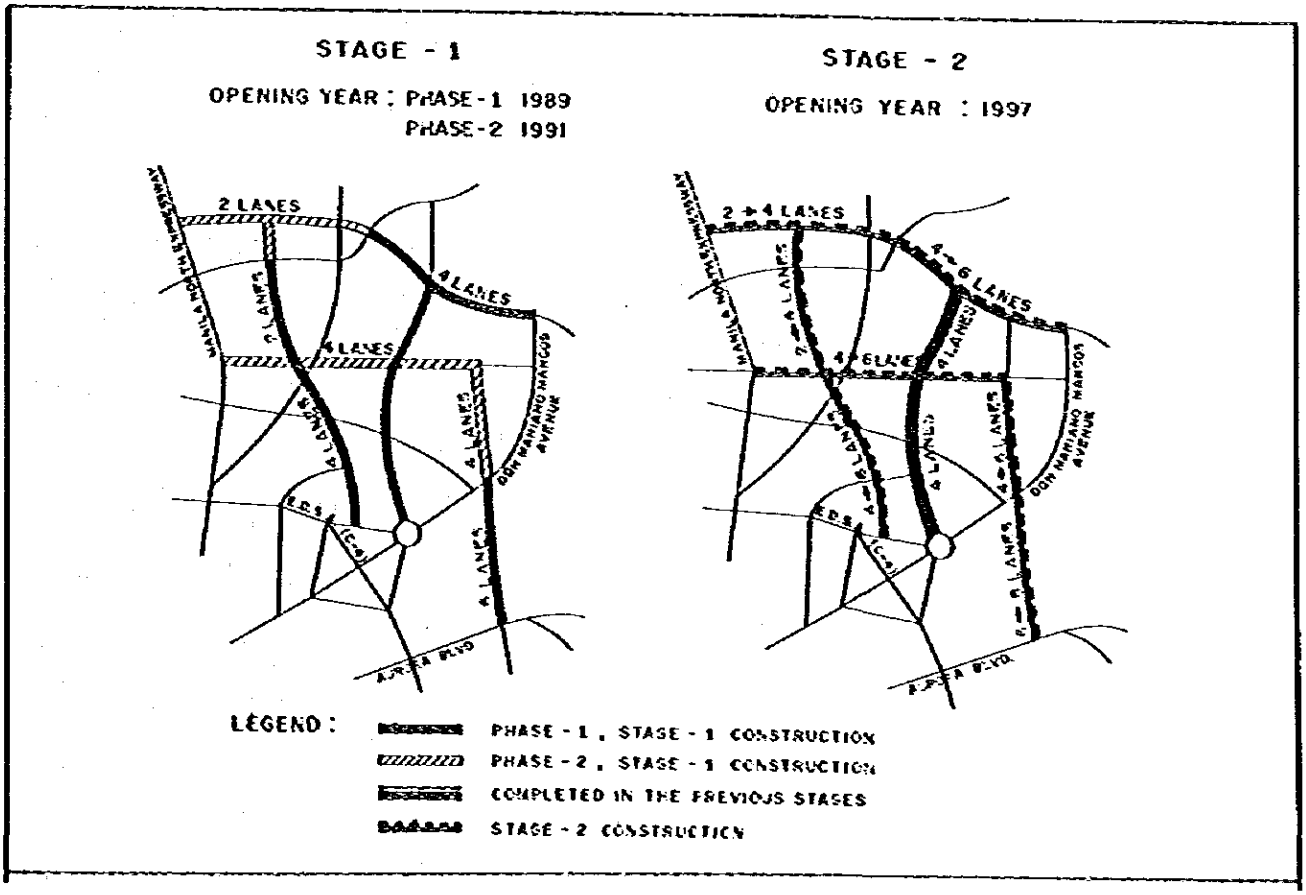
A. CONCLUSION

The result of the project evaluation shows that the alternative plans considered for the project roads are all economically feasible; provides a road network that would decongest existing heavily travelled roads; assists in the development of the DIZ into a sound and healthy urban area and indirectly contributes to the development of the regional as well as the national economy.

Originally, there were three (3) alternative plans considered for the project roads. The first is a conservative plan aiming at the least investment, the second is an extensive road development requiring the biggest amount of investment while the third is the intermediate plan of the first two. Due to the financial requirement of the project, the second was discarded and the remaining two were subdivided into two types, a circumferential type of road development and the other is a radial type. As the combinations of Plans 1 and 2 with different lane numbers and plans A and B with different priority emphasis either circumferential or radial roads were formulated. The four alternatives, namely, Alternatives 1(A), 1(B), 2(A) and 2(B), were evaluated economically, financially, traffic impact in the area, and its contribution to the regional and national economy.

Taking into consideration all the factors mentioned above, Alternative 1(B), when implemented would achieve the goals of the project roads equally well as the other plans with lesser burden on the NCR's annual road budget.

FIGURE 1. RECOMMENDED PLAN



B. RECOMMENDATIONS

1. Project Roads

a. The project which is in accordance with the road network plan of the NCR and supportive to the strategic development plan of the OIZ should be implemented as early as possible for the much needed acessibility and systematic development of the area.

b. The project be implemented under Alternative 1(B) which initially requires the minimum improvement level for the realization of the goals of the project. The table below summarizes the different stages and phases of the project.

TABLE 1 NECESSARY NUMBER OF LANES

ROAD SECTION	NO. OF LANES STAGE 1 PHASE 1	STAGE 1 PHASE 2	STAGE 2
C–5			
Republic Avenue	–	4	6
Luzon Avenue	–	4	6
Katipunan Avenue	6	–	8
C–6			
MNDR–Quirino Highway	–	2	4
Quirino Highway to Don Mariano Marcos Avenue	4	–	6
Mindanao Avenue			
North Avenue to C–5	4	–	6
C–5 to General Luis Road	2	–	4
General Luis Road to C–6	–	2	4
Visayas Avenue			
Elliptical Road to C–6	4	–	4

c. The design be in accordance with the proposed role and function of the project roads. The proposed role and function of the project roads are:

* C–5 will be a major road that will provide a balanced distribution of traffic and serves as a spine in the orderly urbanization of the area. The design of the different sections of this road should be compatible with the land use along its length.

- Katipunan Avenue with several universities and colleges mixed with residential areas.

- Luzon Avenue mostly with subdivisions. The proximity of the New Far Eastern University would attract other institutional uses along its length.

- Republic Avenue will be an important road that leads to Batasan Pambansa. Aesthetics be a special consideration in the design of this section of C–5.

* C–6 function is the same with that of C–5. The whole length of C–6 project traverses large and small scale subdivisions but proliferation of industries is expected along its length.

* Mindanao and Visayas Avenues belong to a secondary major road providing direct link between the DIZ and the urban centers of Metro Manila. Typical land use along its length are residential houses.

d. The following investment funds be made available for the project implementation:

TABLE 2 INVESTMENT PROGRAM
(Million pesos, 1982 prices)

	Stage I		Stage 2	Foreign Currency	Local Currency	Taxes	Total
	Phase I	Phase 2					
1984	9.43			5.66	2.54	1.23	9.43
1985	83.89			1.88	81.60	0.41	83.89
1986	126.80			44.12	71.23	11.45	126.80
1987	136.76			58.84	62.67	15.25	136.76
1988	78.35	59.51		44.12	82.59	11.45	126.80
1989		117.04		51.48	52.21	13.35	117.04
1990		91.36		51.46	26.56	13.34	91.36
1991							
1992							
1993			7.94	4.76	2.14	1.04	7.94
1994			2.63	1.58	0.71	0.34	2.63
1995			186.89	102.43	58.22	26.24	186.89
1996			186.86	102.43	58.21	26.22	186.86
TOTAL	435.23	268.21	384.32	468.76	498.68	120.32	1,087.76

e. The project should be implemented according to the following schedule:

Detailed Engineering for Stage 1	1984-1985
Acquisition of Road Right-of-Way	1985-1989
Construction of Phase 1	1986-1988
Construction of Phase 2	1989-1990
Detailed Engineering for Stage 2	1993-1994
Construction of Stage 2	1995-1996

f. In case there would be a big discrepancy between the projected and the actual highway funds of NCR, the phasing and staging of the project be adjusted accordingly. The adjustments be in line with the development trust of the government, i.e.,

- To decongest the existing major roads in the area, the Mindanao and Visayas Avenues extensions should be given priority;
- To provide a major access to the Batasan Pambansa from the west, the section of C–5 along the Republic Avenue from the MNE to Don Mariano Marcos Avenue whose ROW has long been acquired will serve this purpose and at the same time provide the development along the route.
- To provide the accessibility need of the expected industrialization on the fringes of NCR, the C–6 project should be considered.

The emphasis here, is that the projects could be implemented by subdividing the different phases into several segments for implementation if there would be some problems in the funding of the project, or Stage 1 could be implemented immediately if it could be accommodated in the NCR highway budget.

g. Since land acquisition can be a serious obstacle to road construction in urban areas, MPWH's close contact with and full coordination of relevant offices of Quezon City, Caloocan City, and Municipality of Valenzuela, as well as the Human Settlements Regulatory Commission, MHS and the Metro Manila Commission be maintained to enforce strict control over development activities on and along the proposed routes of the project roads.

h. Acquisition of the full road right-of-way be undertaken after completion of the detailed engineering.

i. Financing institutions be anticipated to fund the detailed engineering and if possible, the actual construction.

2. Related Roads

a. Existing Roads

(1) In view of the difficulty to further widen Quirino Highway, Tandang Sora Avenue, and General Luis Road due to heavy roadside development, their existing road spaces be utilized effectively to the fullest extent.

(2) In line with the projected traffic demand, the Don Mariano Marcos Avenue should be widened to 6-lanes in 1990 and to 8-lanes in year 2000 due mainly to the urbanization of the DIZ including the Batasan Pambansa and the Capitol Hills Urban Land Reform Zone Projects.

(3) MNE be upgraded to a 6-lane road before year 2000.

(4) Aurora Boulevard, which is one of the most congested roads even if with the project, will be difficult to widen due to heavy built-up commercial establishment along the road. The road network in the vicinity of Aurora Blvd. should be assessed to find how they may complement the capacity of the Boulevard.

(5) North Avenue, which joins with Mindanao Avenue, be upgraded in the future to its ultimate section within its 30.00 meter right-of-way.

b. New Roads

To maximize the effectiveness of the project roads as well as efficient use of resources, the construction of the following roads be seriously considered:

C–5:

Section from MNE to MacArthur Highway

Section from Aurora Boulevard to Rodriguez Avenue

C–6:

Section from the Don Mariano Marcos Avenue eastward

Section from MNE to MacArthur Highway

Republic Avenue:

Section from Luzon Avenue to Don Mariano Marcos Avenue

Congressional Avenue:

End of Congressional Avenue to Visayas Avenue

Luzon Avenue Extension:

Section from Republic Avenue to C-6

C. PROJECT IMPACTS

1. Traffic Impacts on Other Major Roads

The serious traffic congestion predicted to occur on the existing roads in the years 1989 and 2000, without the project ("Without" Case), will substantially be improved by the implementation of this Project ("With" Case). In 1989, the opening year of Phase 1, Stage 1, the average level of service of the road network "With" and "Without" cases are 0.75 and 0.88, respectively. The total length of congested roads in the network without case with V/C ratio more than 1.0 is about 102.3 kilometers compared to only about 55.7 kilometers with the project. For year 2000, even with the implementation of other related roads, the average V/C without project would increase to 1.1, meaning most of the major roads in the DIZ will heavily be congested compared with the project of only 0.89, the road network could still accommodate the traffic demand in the area. Shown in the tabulation below is the traffic impact of the project.

TABLE 3 TRAFFIC VOLUME

(1,000 PCU/day)

MAJOR ROADS	1989				2000			
	Without	With	Decrease		Without	With	Decrease	
EDSA (C–4)	120.0	108.2	11.8	(10%)	165.3	125.2	40.1	(24%)
Tandang Sora Avenue	19.0	15.9	3.1	(16%)	28.9	13.7	15.2	(53%)
Gen. Luis Road	21.8	18.6	3.2	(15%)	26.3	11.2	15.1	(57%)
Ourino Highway	38.2	31.9	6.3	(16%)	68.3	38.5	29.8	(44%)
MNE	75.1	65.1	10.0	(13%)	119.7	84.4	35.3	(29%)
Don Mariano Marcos Avenue	129.2	88.8	40.4	(31%)	152.7	98.6	54.1	(35%)

2. Developmental Impact

The DIZ is under the strong development pressure, however, development is rather stagnant in most areas of the DIZ except on the adjacent areas to the existing roads, due mainly to the problem of accessibility.

The Project Roads, when implemented, will provide direct and even access to most areas of the DIZ, thereby accelerating the urbanization of the DIZ in a sound and orderly manner.

3. Contribution to National and Regional Economy

The rate of return of the investment of the project roads was estimated at 46.3%. This return of the investment are from the benefits of the project that have either direct or indirect contribution to the regional and national economy. The direct impact is the savings in fuel consumption (gasoline and diesel) from the running cost of the vehicle operating costs. In the opening year alone of Phase I, Stage 1 in 1989, the quantified savings in fuel consumption is about ₱104.4 million, ₱146.2 million in 1991 and ₱198.5 million in 1997, all in 1982 market price.

In terms of monetary value of the savings in fuel consumption, about 60% of the value represent the foreign cost. This foreign cost savings could contribute to the international trade deficit of the country or dollar outflow of foreign currency. The amount of foreign cost savings in the opening year of Stage 1 would amount to about U.S. $10.3 million and expected to increase more than twice after completion of Stage 2 in 1997.

D. SUMMARY

1. BACKGROUND OF THE PROJECT

The Philippine Government has envisaged various transport plans to relieve Metro Manila of unfavorable traffic conditions suppressing its important functions in the regional and national economy. These plans, composed of traffic management and construction of roads, were short or medium range programs to guide transport investment operation within a context of rational land use pattern. The implementation of these plans is expected to improve the movement of goods and people in the area and at the same time promote an orderly land use pattern in accordance with the development strategy for Metro Manila.

Among the major highways recommended for implementation, the major roads located within the inner area (inside Circumferential Road 4 also known as EDSA) are either completed, under construction or are being programmed for implementation. The major roads outside EDSA that were given high priority for implementation are located in the south and north of NCR. The roads in the south were subjected to a detailed feasibility study in 1980-81 with technical assistance from the Japan International Cooperation Agency. In response to another request of the Government of the Philippine (GOP), JICA is again extending technical assistance for the conduct of the Feasibility Study for the Metro Manila Outer Major Roads Project, Northern Package.

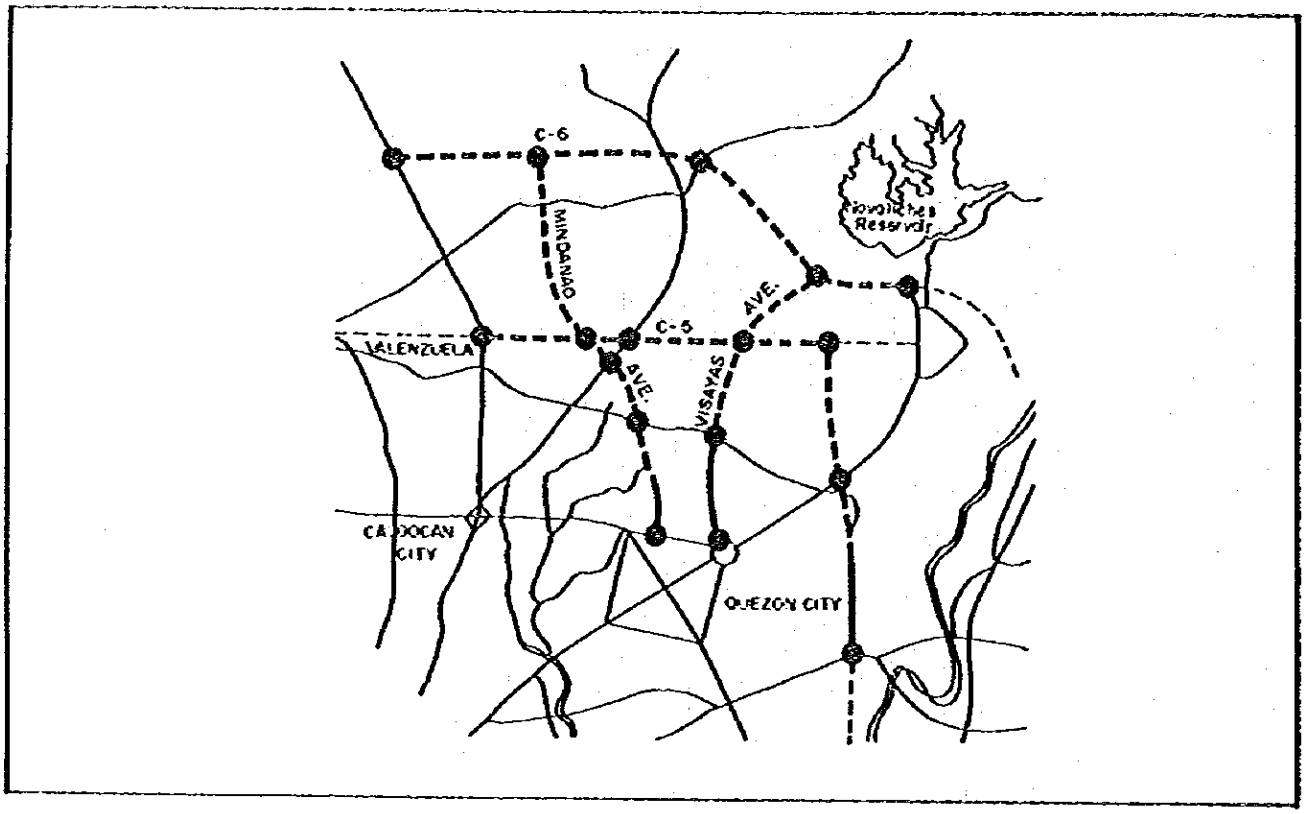
2. THE PROJECT

The Study is principally to determine the technical, economic and financial feasibility of the construction of the following roads:

- Circumferential Road 5 (C–5) from the Manila North Expressway to Aurora Boulevard (R–6), via Republic Avenue and Katipunan Avenue, about 15 kilometers in length.
- Circumferential Road 6 (C–6) from the Manila North Expressway to the Don Mariano Marcos Avenue (R–7), about 12 kilometers in length.
- Mindanao Avenue from North Avenue to Circumferential Road 6 (C–6), about 9 kilometers in length.
- Visayas Avenue from Elliptical Road to Circumferential Road 6 (C–6), about 8 kilometers in length.

Shown in Figure 2 are the project roads including the location of related major intersections.

FIGURE 2. PROJECT ROADS AND RELATED INTERSECTIONS



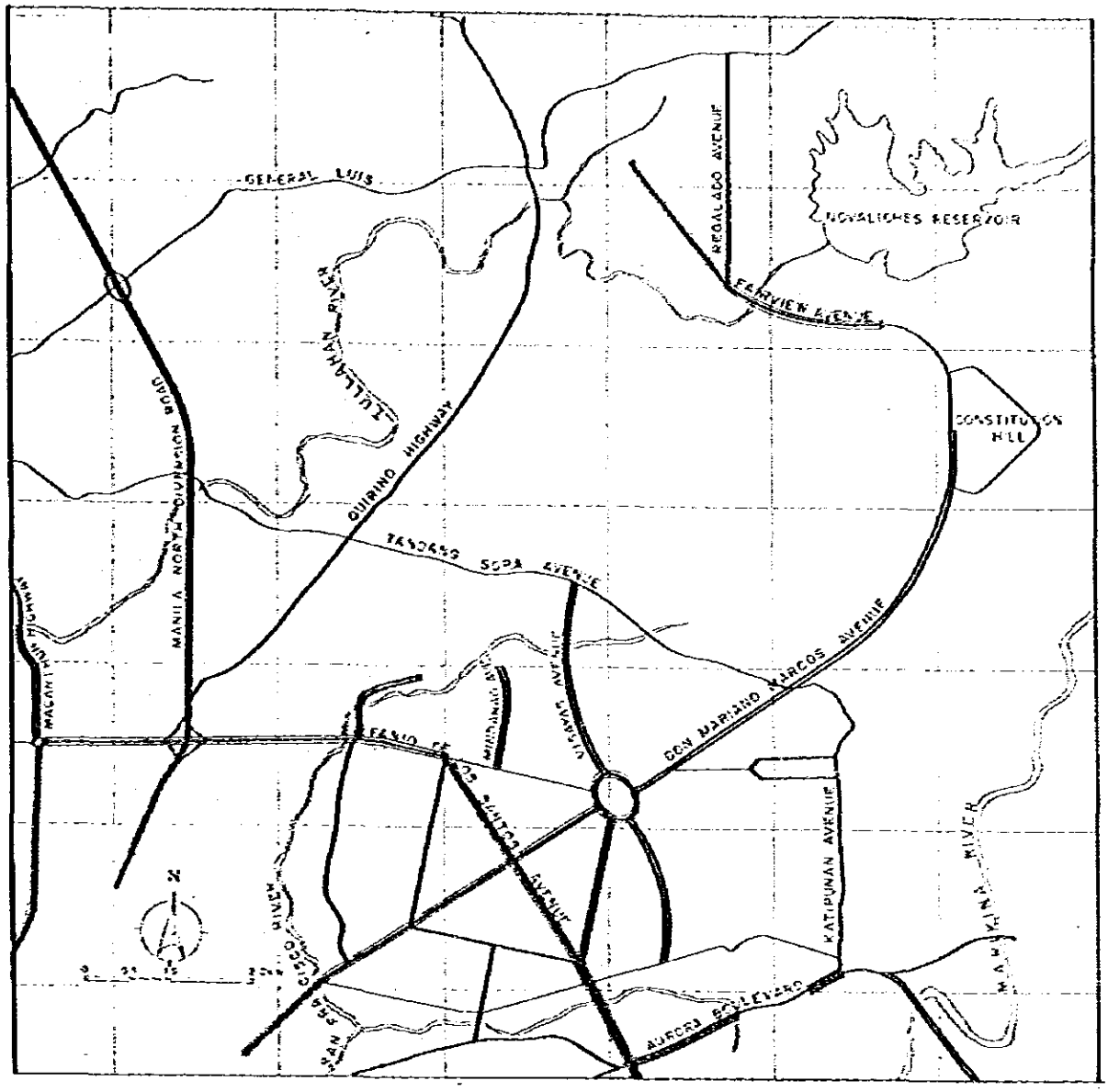
3. DEFICIENCIES OF THE PRESENT ROAD NETWORK IN THE DIZ

The road network existing in the DIZ is basically composed of five radial roads: Aurora Boulevard (R-6), Don Mariano Marcos Avenue (R-7), Quirino Highway (R-8), Manila North Expressway, and MacArthur Highway. These radial roads, functioning individually due to the absence of major circumferential roads, are presently cross-connected by Katipunan Avenue (offering connection between R-6 and R-7), Tandang Sora Avenue (connecting R-7, R-8, and MacArthur Highway), General Luis Road (connecting R-8, Manila North Expressway, and MacArthur Highway), and C-4 (connecting all radial roads). (See Figure 3).

The road network in the DIZ is inadequate, because no major roads are found in:

- the areas of approximately 28.8 square kilometers bounded by Quirino Highway, Tandang Sora Avenue, and Don Mariano Marcos Avenue
- the area approximately 15.2 square kilometers bordered by the Manila North Expressway, Tandang Sora Avenue, Quirino Highway, and General Luis Road; and
- the area approximately 19.6 square kilometers bordered by Aurora Boulevard, Katipunan Avenue, Don Mariano Marcos Avenue, and the Marikina River.

FIGURE 3. EXISTING ROAD NETWORK IN THE PROJECT AREA



LEGENDS.

- SINGLE 2 - LANE
- SINGLE 4 - LANE
- SINGLE 6 - LANE
- DUAL 2 - LANE
- DUAL 3 - LANE
- DUAL 4 - LANE

The essential facility that would promote a sound and orderly urbanization in the DIZ which is being marked as a land suitable for the absorption of future population increase in the NCR is a well planned and adequate road network. The slow pace of urbanization in the DIZ could be attributed to the following:

* Inadequate Major Road Network

  Major road densities in Quezon City, Caloocan City, and Valenzuela are as low as 0.64, 0.38, and 0.56 kilometer per square kilometer, respectively, which are all less than the NCR's average of 0.72.

* Uneven Spread of the Road Network

  The area about four (4) kilometers north of C–4 presently has a relatively fine network while the rest of the DIZ could be described as an uneven network.

* Inadequate Traffic Capacity of Existing Roads

  The existing roads are closely approaching their traffic capacity limits and widening of the existing right-of-way to increase their capacity would entail nearly prohibitive amount of time and cost except on some roads which still have room for improvement within their right-of-way width.

  Due to these problems, the implementation of the project roads will make the road network function as a system and at the same time will facilitate the urbanization of these areas in a sound and attractive manner.

4. PLANNING FRAMEWORK

1) Population

The Philippines' population increased by 6.2 million in five years from the 42.1 million in 1975 to 48.3 million in 1980.

NCR is presently industrialized and urbanized offering high employment opportunities resulting to a population increase of about two million in the past decade from 3.97 million in 1970 to 4.97 million in 1975 to 5.95 million in 1980, with an annual average increase rate of 4.61% during the first half-decade (1970-1975) to 3.66% during the second half. In spite of the decreasing growth rate, the ratio of the NCR population to the national population increased from 10.8% in 1970 to 12.3% in 1980.

Based on the population census data from 1960 to 1980, the Technical Committee on Population, NCSO has completed in 1982 the forecast up to the year 2030 of national, regional, provincial, and municipal populations.

The NCSO forecast envisaged a 20-year population increase of 21.6 million from the 48.3 million in 1980 to 69.9 million in the year 2000 (with mid-point population of 60.2 million in 1990). NCR's population is forecasted to increase by 3.8 million in the same period from 5.9 million in 1980 to 9.7 million in year 2000 (7.9 million in 1990). The population of the Study Area, on the other hand, will increase by about one million every five years for a 20-year total of 4.3 million from the 6.6 million in 1980 to 10.9 million in year 2000 (8.9 million in 1990).

The Study Area is divided into five blocks, namely North–1, where the DIZ is located, North–2, Manila, East and South. The population of Manila Block, where the urbanization has reached saturation, will increase little. North–1 Block will account for 41% (1.75 million) of the estimated total 20-year increase of 4.3 million in the Study Area population, and South Block will account for 42% (or 1.79 million) thus, these two blocks will absorb 83% of the future increase in the Study Area population. It follows that priority emphasis for the development of social infrastructure will have to be placed on these two blocks.

2) Economy

The new Five-Year Development Plan 1983-1987 presents at strategy of self-sustained economic growth steadily at the projected base of an average 6.5% annual growth of GNP (1972 constant price).

The National Capital Region (NCR) which is the seat of the national government and the key of national economy also pursues a sustainable economic growth alongg with the national Five-Year Plan. NCR, holding an estimated one-eight of the total population and generating some one-third of the total output in 1981, projects its GRDP to grow at 5.9% per annum for 1983-1987.

3) Urbanization

a) NCR Development Strategy

The 1982 CIF Report made the following recommendations on the future urban growths:

i. growth on the plateau to both north and south of the urban area should be actively supported and encouraged;

ii. growth in the Marikina Valley and the Laguna lowlands should not be encouraged; and

iii. urban growth to the northwest in the area of the fishponds should not be encouraged.

For the achievement of the recommended goals, the government will have to make continued efforts to:

i. actively develop infrastructures in areas where development is to be encouraged;

ii. accelerate the implementation of projects such as the Government Center Project, which will substantially contribute to regional development; and

iii. enforce the Zoning Ordinance for the control of development activities.

The development patterns for 1990 and for 2000 was studied in the light of the NCR development strategy.

b) Urban Development Pattern for 1990

Development efforts up to 1990 should emphasize on North–1, North–2, and South Blocks. Land demand up to 1990 in North–1 Block can be adequately met within the existing urbanization areas in the Block. The development of the fishponds northwest of Manila Coastal Margin, Marikina Valley, and Laguna lowlands should be held back in view of the huge amount of public sector investment needed for land improvement, as well as for the purpose of protecting fishery and farming activities in these areas. Development in East Block should be limited to the existing Lungsod Silangan Project (See Figure 4).

c) Urban Development Pattern for Year 2000

With continued development toward North–1, North–2 and South Blocks, and additional land demand of approximately 270 hectares will have to be met in the East Block. It is anticipated that development efforts up to year 2000 will have to be extended towards these directions. Although it is highly possible that East Block will, in view of its proximity to Manila, become suitable land for urban development, the flooding of the Marikina River should be controlled and drainage and sewerage facilities developed, feasibility of developing a self-sufficient urban area, such as that envisaged under the Lungsod Silangan Project, should be evaluated. (See Figure 5).

4) Future Land Use In the DIZ

The future land use concept map of the DIZ has been drawn basically as follows:

i) The map is based on the zoning map set forth by MMC in 1981 and, for municipalities outside the NCR, the comprehensive development plans formulated by such municipalities in or about 1980 under the guidance of the MHS;

FIGURE 4. EXPANSION PATTERN OF URBAN AREA 1990

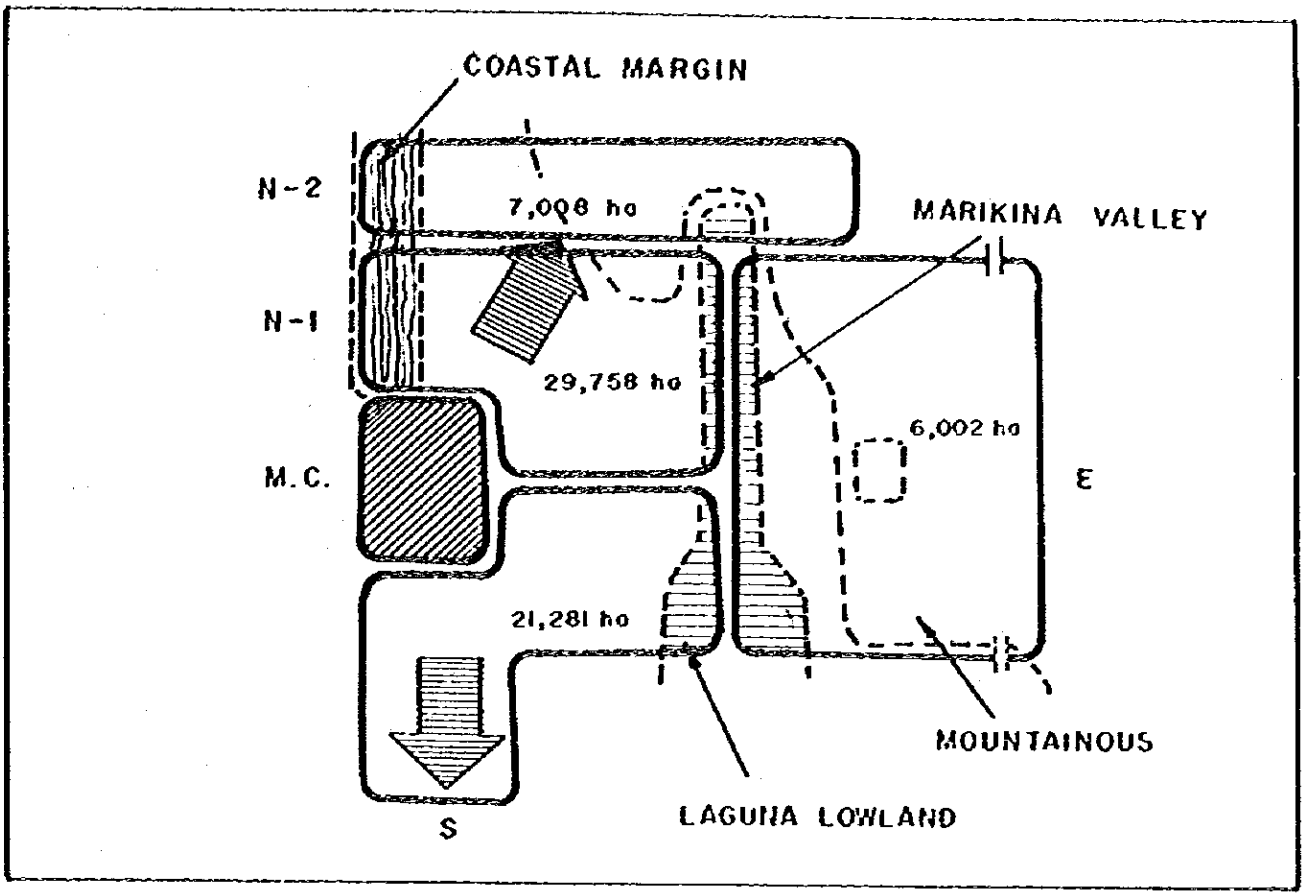
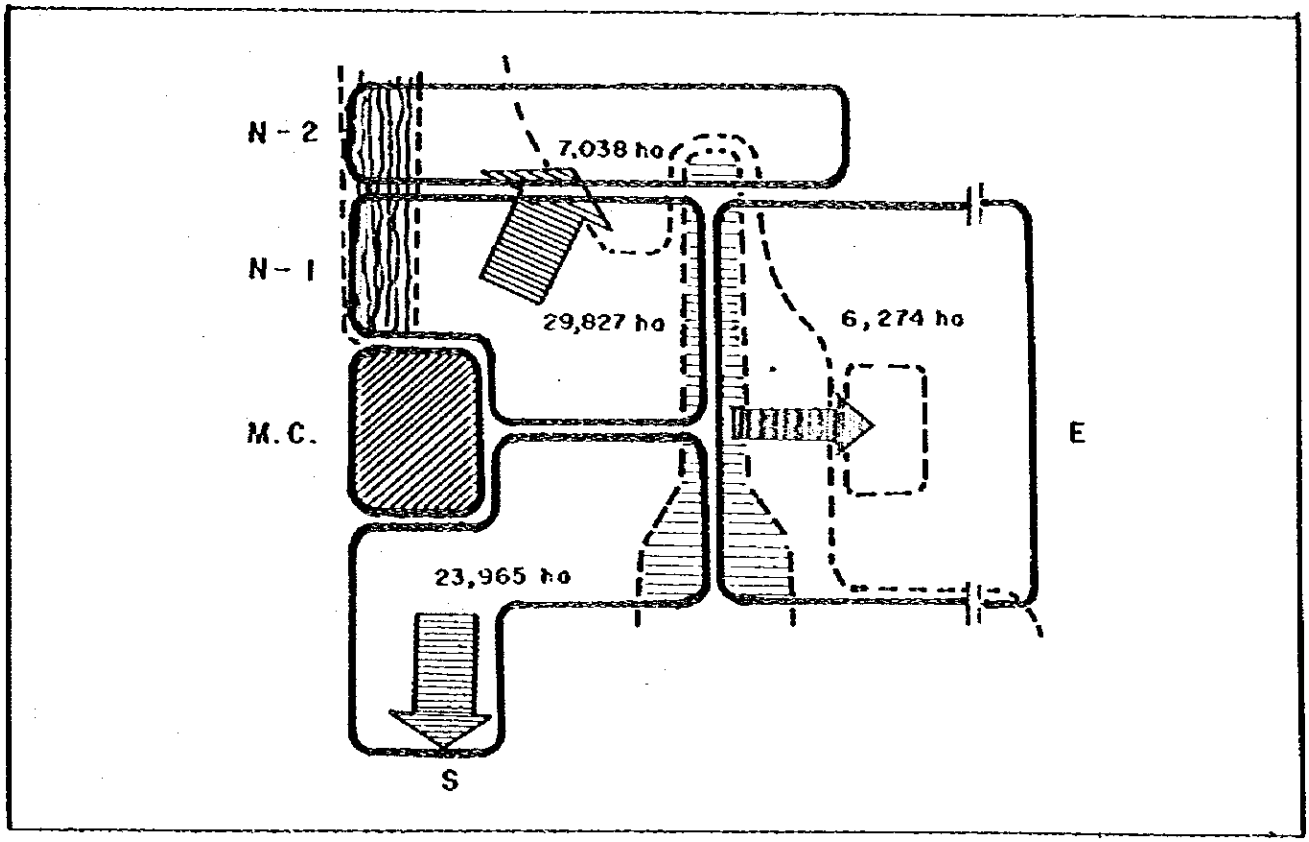


FIGURE 5. EXPANSION PATTERN OF URBAN AREA 2000



ii) Development plan for the NCR is assumed to follow the strategy set forth by the RDFP and the CIF;

iii) The directions or urban expansion is based on the urban expansion pattern shown in Figure 5. Given the slight difference in urban growth directions between 1990 and 2000 and, then, such map is drawn for 1990 assuming that urban areas will be developed by 1990 in accordance with the 2000 map with some unoccupied pieces of land still remaining;

iv) The comprehensive development plans of municipalities outside the NCR contemplated on fairly large scale industrial development. Since the development concepts for such municipalities, adjacent to the NCR, must be in harmony with the development trends of the NCR, industrial sites must be located chiefly along the Manila North Expressway;

v) The land use concept map is to reflect the Government Center Project and the Capitol Hills Urban Land Reform Zone Projects, which will strongly influence the direction the DIZ is to be developed; and

vi) The distribution of various land uses is to be planned to achieve the development of an urban area in which to worker's commuting distance is minimized.

5. TRANSPORT DEMAND

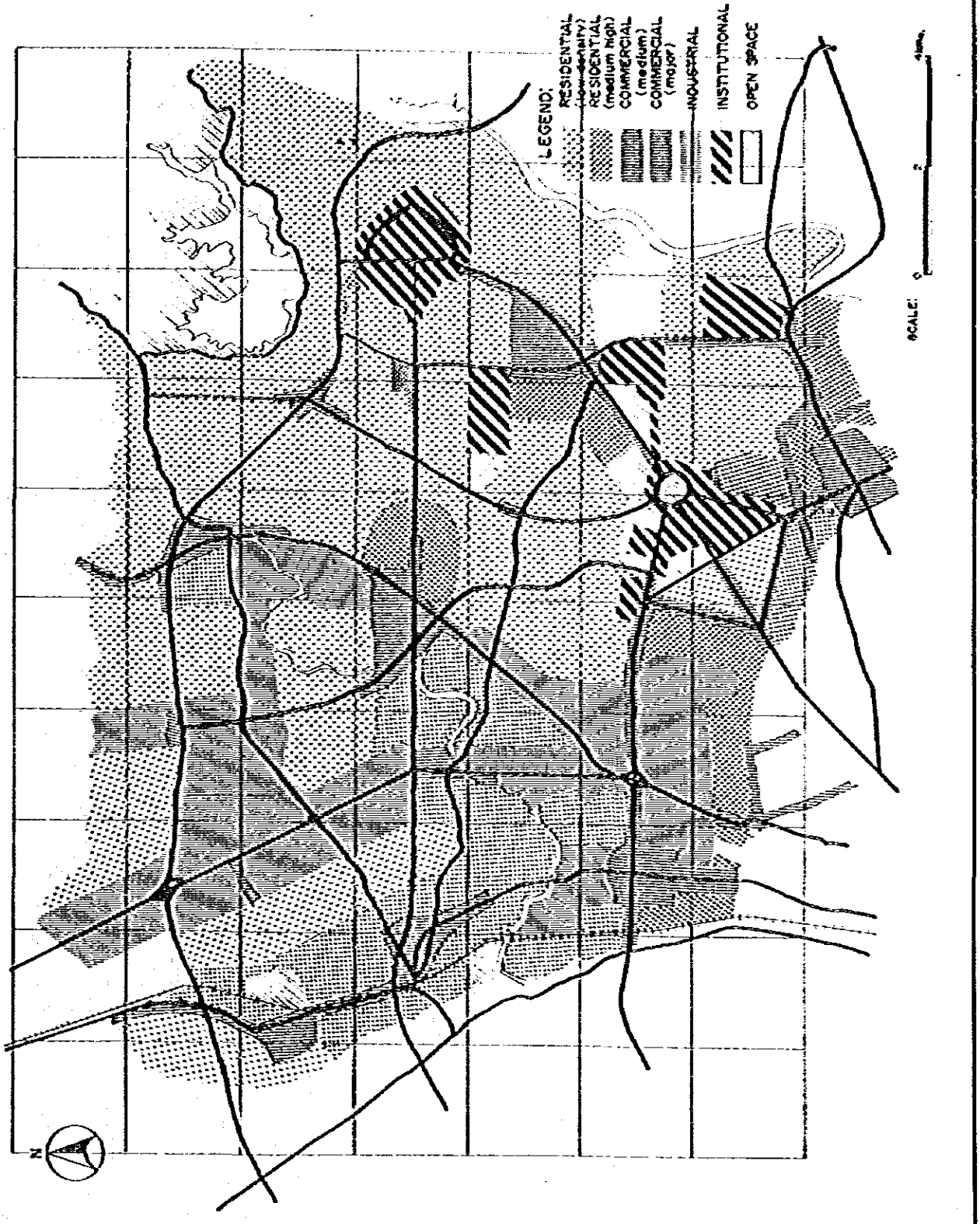
1) Present Traffic Characteristics

The total traffic moving within, and traffic flowing in or out of Metro Manila, averaged to 10,864,000 person trips per day in 1980, 69.7% or 7,557,000 person trips per day, riding on public utility vehicles, followed by 24.2% or 2,627,000 person trips per day using private cars, 4.6% or 499,000 person trips per day utilized the taxi, and 1.5% or 163,000 person trips per day utilizing trucks. The indicated high utilization of public utility vehicles was supported by the high service frquency and the tight service networks of jeepneys and buses. The majority of person trips per day was generated in the CBD (Manila), at 32% of the total or 3,229,000, followed by Quezon City (20% or 2,062,000), Caloocan City (7% or 715,000), and Makati (7% or 707,000), representing two-thirds of the total trips.

The highest trip purpose is "going home" with 44%, followed by "going to school" with 20% and "going to work" with 17%, and it is noteworthy that students, whose fare capacity was low represented about 45% of public utility vehicle passengers.

Of the road network of NCR, the heaviest traveled road is EDSA (C-4) with 40,000 to 80,000 vehicles per day (14 hours traffic count), followed by South Superhighway (R-3), Magsaysay Boulevard, Rizal Avenue (R-9), each with over

FIGURE 6. STRUCTURAL LAND USE PLAN



50,000 vehicles per day. Traffic on Quezon Boulevard, one of the busiest roads exceeds 50,000 vehicles per day in some sections. These major roads are congested not only during morning and evening peak hours but also during daytime.

Trip densities in the DIZ showed Cubao and the southern part of Caloocan City with a high trip density of 500 or more person trips per hectare. Trip density distribution in the DIZ generally presents clearly a concentric ring pattern around the CBD with diminishing density as distance from CBD increases.

In the DIZ, large traffic volumes are observed on the Manila North Expressway, while the Don Mariano Marcos Avenue has an average of about 30,000 vehicles per day and Quirino Highway, 18,000. Other trunk roads are counted with heavy traffic volume of over 10,000 vehicles per day. These trunk roads in the DIZ are functioning as radial roads connecting the DIZ with Manila and Cubao. At present, there are no circumferential roads in the DIZ, which are essential to accommodate the increasing centripetal traffic flow into Manila and Cubao.

2) Future Traffic Volume

The volume of car and PUV trips generated in the Study Area was 11,423,000 person trips per day in 1980, and is estimated to increase to 16,651,000 and 22,621,000 person trips per day in 1990 and 2000, respectively, and these growths correspond to average annual increase rates of 3.8% in the first decade (1980-1990) and 3.1% in the second decade (1990-2000), the decline being in line with the decline in population increase rates.

The volume of truck traffic is estimated to increase at 5.9%, the annual average growth rate of GRDP, from 301,000 person trips per day in 1990 to 536,000 in 2000.

The CBD (Manila) shows the lowest transport demand growth factor of 1.2 from 1980 to 2000, while traffic zones along EDSA located about 8 to 10 kilometers from the CBD show factors of 1.8 to 2.2, those along C–5, some 15 kilometers from the CBD and where intensive development is expected, show factors of over 3.0, and the Constitution Hill area, where the Capitol Hills Urban Land Reform Zone Project and other development projects are on-going, shows the factor of 8.1. The further away the traffic zone from the CBD, the higher the growth factor.

At present, traffic density of the areas along the Project Roads is 30 to 60 person trips per hectare, whereas, that of the areas along EDSA (C–4) is about 270. In the year 2000, traffic density in the areas along C–5 will be 140 to 200 person trips per hectare, which is about 2/3 of the present traffic density in the area along EDSA. Traffic density in the areas along C–6 will be 100 to 150 person trips per hectare, which is about 1/2 of the present traffic density in the area along EDSA.

The share of private cars to the total person trips (persons using private cars and/or public utility vehicles), was estimated to increase from 25.5% in 1980 to 33.6% in year 2000 mainly due to the predicted increase of car ownership which

has a low transport efficiency. This change in modal split also reflects the degree of transport efficiency, i.e. to transport 1,000 person trips in 1980 requires only 194 pcu to 219 pcu in year 2000 or an increase of about 13%. For this reason, the PUV system should be strengthened to be an efficient transport system thereby maximizing the use of available road space, or more passengers transported per unit length of road.

6. SELECTION OF THE OPTIMUM ROUTE AND FORMULATION OF ALTERNATIVE PLANS

1) Role and Function of the Project Roads

C–5

This circumferential road, which will function as a major distributor of traffic, will substantially contribute to the improvement of traffic condition along C–4, the most important thoroughfare in the NCR, and at the same time share traffic coming from the northern parts of Luzon that are presently using the MNE and the MacArthur Highway. Locally, it will distribute traffic from Quirino Highway to Mindanao Avenue and/or Visayas Avenue.

C–6

This is the outermost circumferential road of the NCR, whose function and classification are the same with that of C–5. When constructed, C–6 will distribute traffic on the Quirino Highway to Mindanao Avenue and/or Visayas Avenue. In the future, the whole legnth of C–6 will become an important road for connection between satellite cities that will be developed on the fringes of the NCR.

Mindanao and Visayas Avenue

These roads belong to a secondary major road and their main function is to attract traffic presently using existing congested radial roads via C–5 and C–6. Also, they will service the generated traffic along its length and traffic from Quirino Highway to C–4 and/or C–5.

In addition to their traffic function, the project roads will function as developmental roads. The Project Area presently lacks adequate major roads, and therefore, sporadic concentrations of development activities are seen in the areas along the existing roads. The strong development pressure on the project area, will necessitate the construction of the project roads to accelerate development of this area into an orderly land use.

2) Selection of Optimum Route

The major steps used in the establishment of candidate routes up to the selection of optimum route are described below:

a) Selection of Candidate Routes

Candidate routes were established by first determining the general corridor of each project road, and within the corridor, control points, such as open areas, existing roads, reserved right-of-way that could be utilized including those areas that should be avoided, such as schools, churches, commercial centers, high density residential areas, were marked in an aerial photo. From this map, all possible alignments of each project road were established and were screened down to two or three competitive routes (see Figure 7).

b) Selection of Preferred Routes

The candidate routes of each project road were evaluated individually using such factors as social and environmental impacts, engineering impacts, difficulty of implementation and construction cost. One or two of the candidate routes were selected for each project road and are summarized below:

TABLE 4 PREFERRED ROUTES

Project Road	*Preferred Routes*
C–5	A–1 and A–2
C–6	B–1 and C–4
Mindanao Avenue	C–2 and C–3
Visayas Avenue	D–1 and D–2

c) Selection of Alternative Road Networks

The preferred routes were used in the formulation of alternative road network plans (See Figure 8).

d) Selection of Optimum Routes

The result of the evaluation of the eight (8) alternative road network plans shows that plans 2 and 4 have the highest rating with 88.2 and 83.3 points, respectively.

The alignment of C–5 is the only difference between the two plans. Plan 4 has a more balanced distribution of Circumferential Roads 4, 5 and 6, while Plan 2, has a more balanced distribution of the overall road network. The advantages of Plan 2 over Plan 4 are as follows:

FIGURE 7. CANDIDATE ROUTES

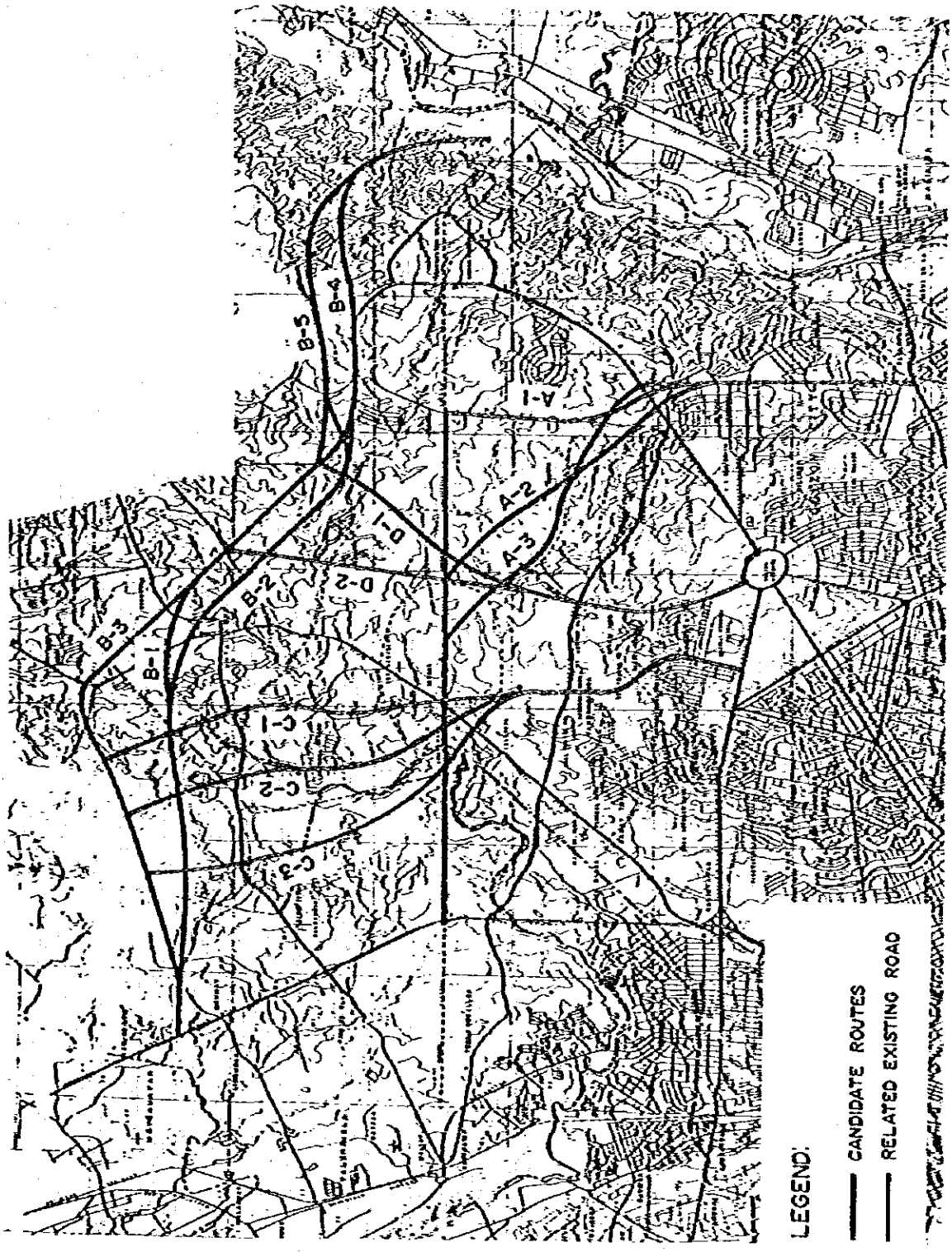
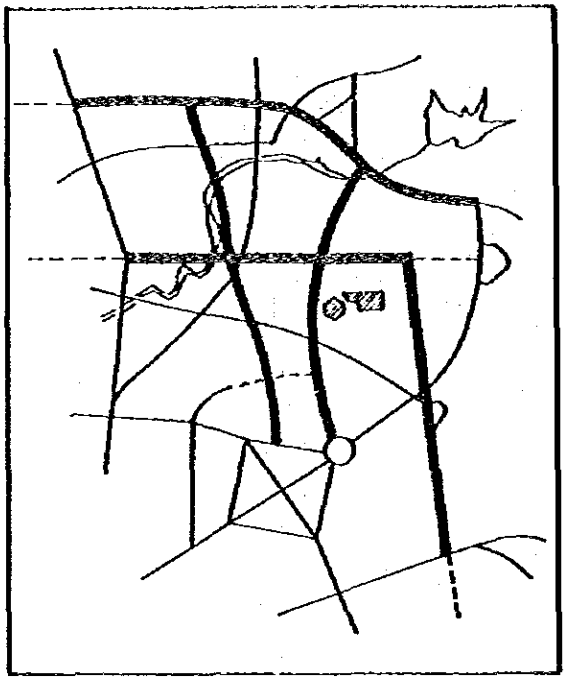
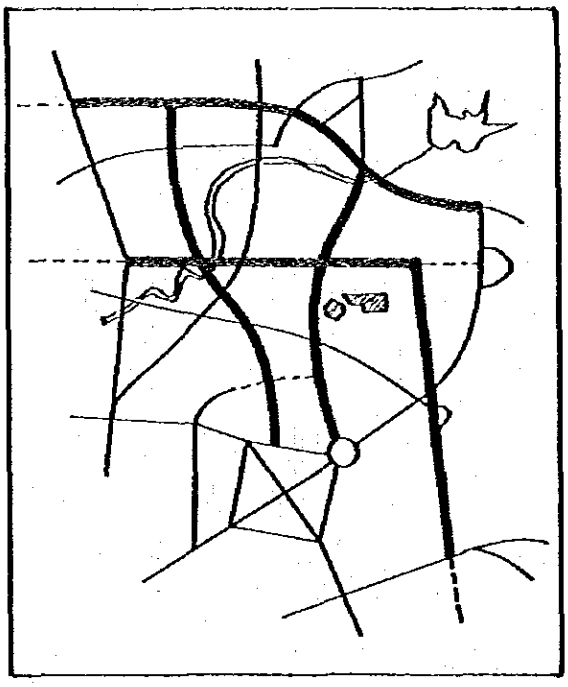


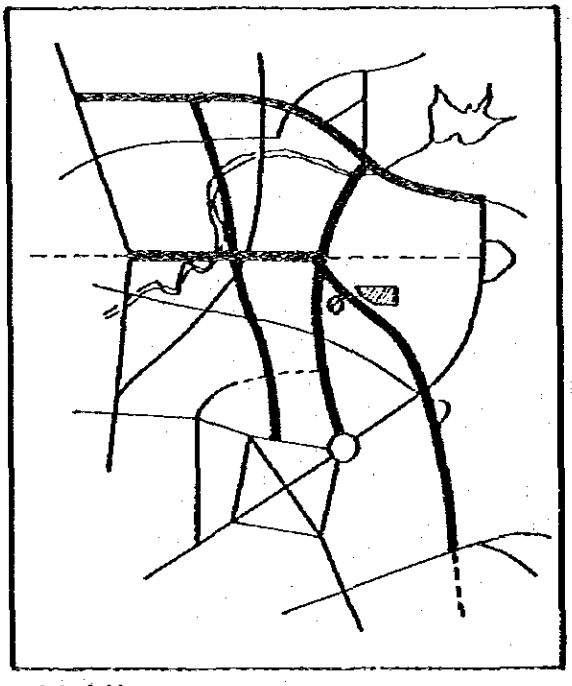
FIGURE 8. ROAD NETWORK ALTERNATIVES



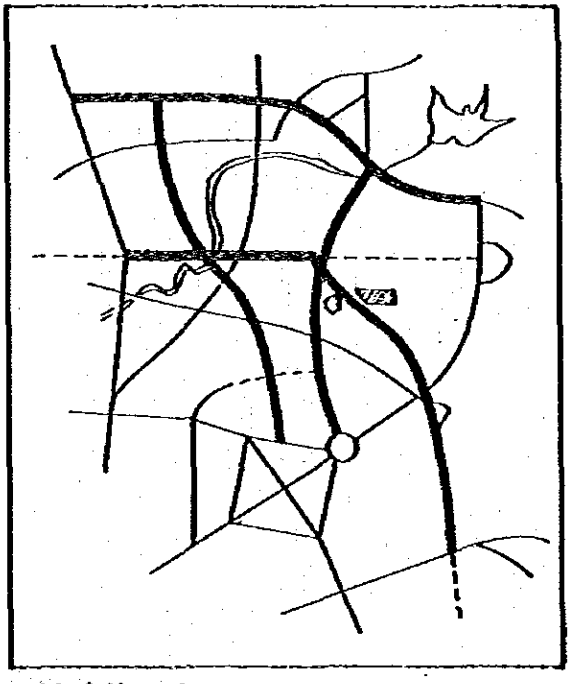
PLAN - 1



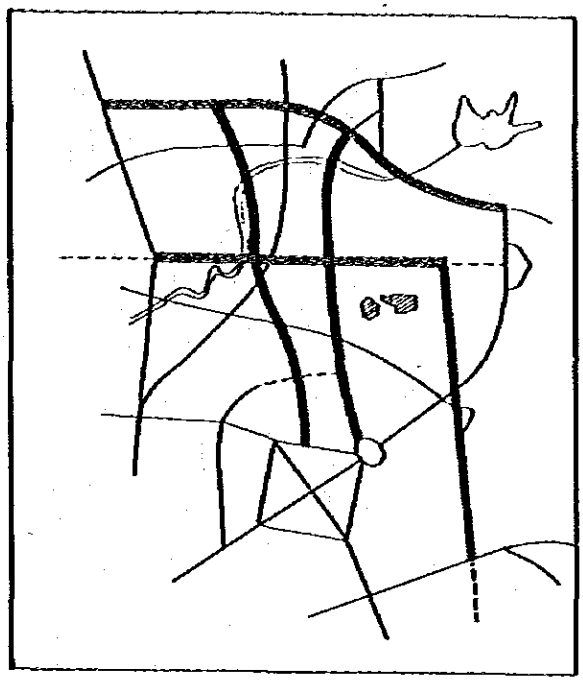
PLAN - 2



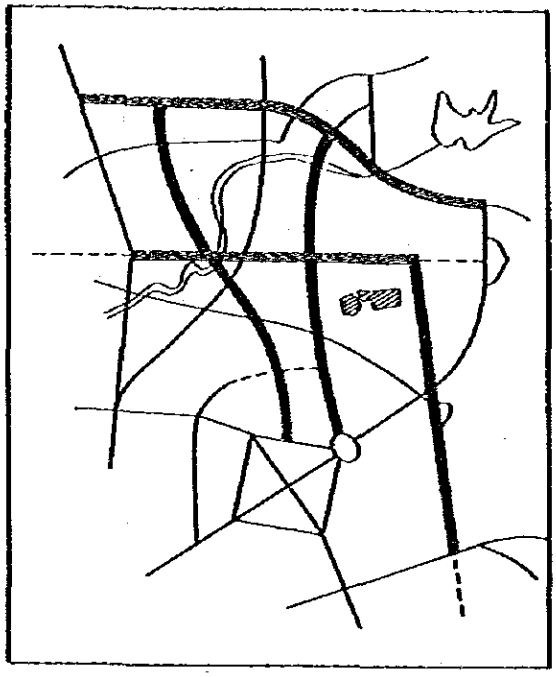
PLAN - 3



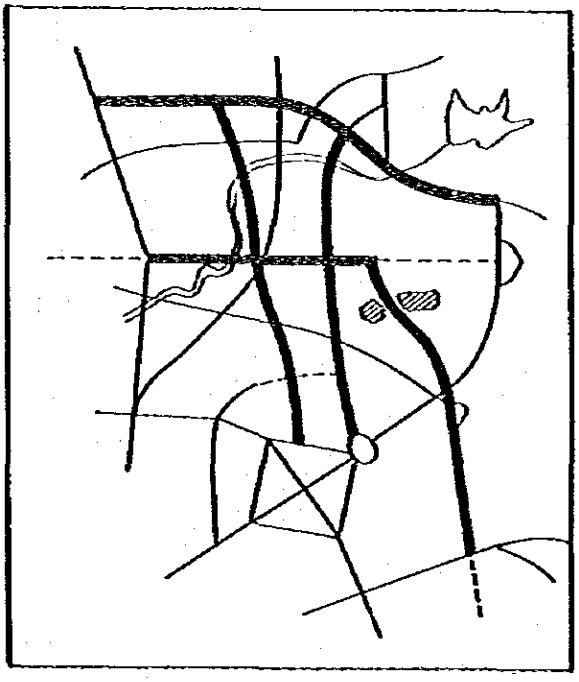
PLAN - 4



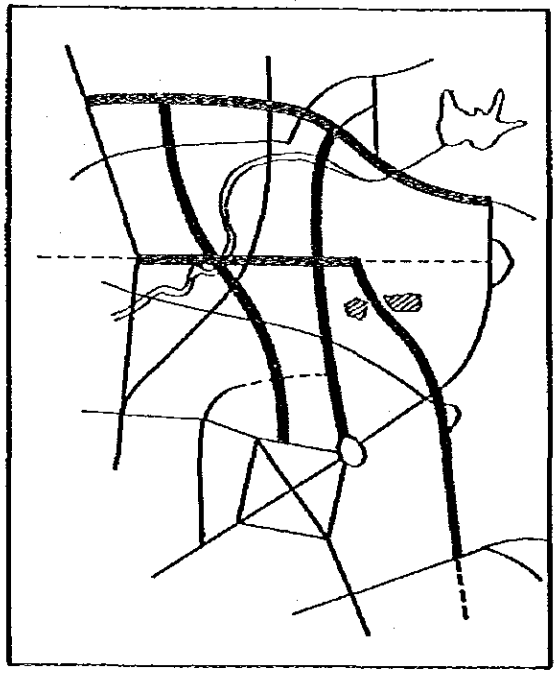
PLAN - 5



PLAN - 6



PLAN - 7



PLAN - 8

- balanced distribution of north-south direction roads which would accelerate a well-balanced development of the area;
- most economical plan;
- Far Eastern University development plan will not be affected; and
- most extensive use of existing roads and reserved right-of-way.

Plan 2 was selected as the optimum road network in the area and the proposed alignment of the project roads is summarized as follows:

TABLE 5 OPTIMUM ROUTE

Project Road	*The Optimum Route*
C–5	A–1
C–6	(B–1) + (B–4)
Mindanao Avenue	C–3
Visayas Avenue	D–1

3) Alternative Plans

a) Policy

Alternative development plans of the recommended optimum routes were formulated using the following factors:

Type of Pavement

Type of intersections and grade separations

Type of bridge and drainage structures

Number of lanes

Phasing of construction

The first three factors were evaluated independently and the result of the evaluation were used in the formulation of alternative plans.

The following are the basic policies in the formulation of alternative plans:

- The entire routes of the project roads be constructed in the initial stage;
- The construction be in two stages with the following type of improvements: (1) aims at the achievement of minimum investment by constructing the minimum number of lanes needed to meet

the traffic demand in each stage, and (2) aims to achieve a higher traffic efficiency in the Project Area as a whole by constructing slightly more lanes than needed to meet the demand in each phase; and that in either alternatives a bus/jeepney lane be constructed in Stage 2 to allow the efficient use of available lanes;

- In view of the amount of annual investment needed for the construction of the project roads in one stage (Stage 1) the construction of Stage 1 be divided into two consecutive phases, Phase 1 and Phase 2;
- The completion of Stage 2 construction be at least five years after the completion of Stage 1; and
- The upgrading, improvement, or construction of existing or new related roads be implemented during the study period on the basis of the established implementation timing of the related roads. (See Figure 9).

b) Road Network Analysis

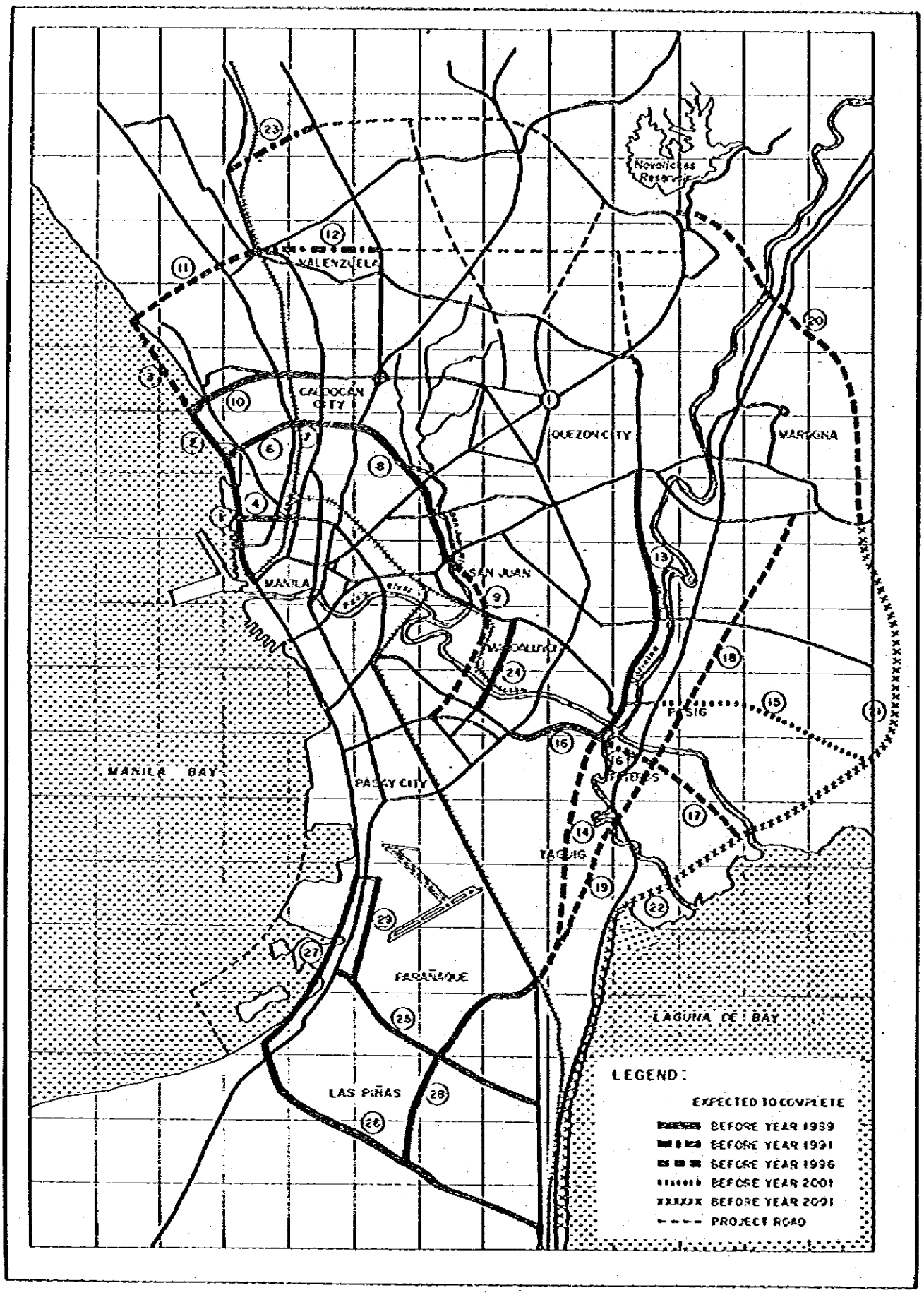
The future road network with and without the project roads were established. To get an indication of the traffic demand on the road network, a non-capacity constraint traffic assignment was undertaken, which allows trips to select the shortest route regardless of the actual road capacity for years 1980, 1990 and 2000. The result of the non-capacity constraint traffic assignment for year 2000 without the project roads indicates that:

- Quirino Highway, with its present limited capacity, will attract large volume of traffic which would require further widening. This, however, is practically impossible due to the present roadside development;
- Tandang Sora Avenue, which is also difficult to widen due to roadside development, would be handling traffic more than its capacity;
- EDSA or C–4, which is the most important thoroughfare in Metro Manila would be handling traffic more than its capacity; and
- The urbanization of the DIZ, especially within the Capitol Hills Urban Land Reform, would generate traffic which will congest the Don Mariano Marcos Avenue and Katipunan Avenues.

c) Number of Lanes

To determine the level of service of the road network, the DIZ was subdivided into several screen lines. The number of lanes necessary to service the future traffic demand by screen lines includes the proposed widening and

FIGURE 9. EXPECTED ROAD CONSTRUCTION SCHEDULE



improvement of other related roads excluding the project roads. The remaining traffic demand will then be served by the project roads. The estimated traffic volume by screen lines for years 1980, 1990 and 2000 and the required number of lanes are presented in Table 6 and Table 7.

d) Formulation of Alternative Plans

Based on the road network analysis and the rquired number of lanes on each screen line, four alternative plans: Alternatives--1 (A), --1 (B), --2(A), and --2 (B) were formulated from two basic plans (Plans--1 and --2) with different number of lanes and two modifications (Plans --A and --B) as Phase 1 of Stage 1 with different priority emphases. The basic plans are described as follows.

Plan--1 aims at the least investment by providing the minimum number of lanes for the project roads just enough to meet the traffic demand.

Plan--2 aims at the achievement of a higher level of service than Plan 1 to attract more traffic from highly congested roads.

Plans--A and --B on the other hand, were established giving different priority emphases on the implementation of Stage 1. Plans--A and --B are described as follows:

Plan--A (Priority Emphasis: Circumferential Roads)

The plan aims at the strengtheming of circumferential road functions in the DIZ and the urbanization of areas along Republic and Luzon Avenues.

Plan--B (Priority Emphasis: Radial Roads)

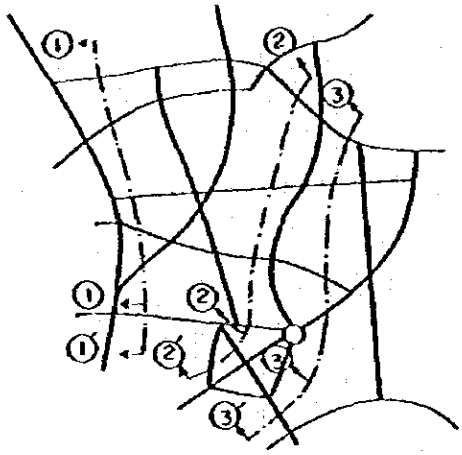
The plan aims at the strengthening of radial road functions and the urbanization of areas along Mindanao Avenue and Visayas Avenue.

7. PRELIMINARY ENGINEERING STUDY

For the preliminary engineering study, particular care was taken to achieve the following:

- The establishment of appropriate design to conform with the existing road network and to maintain continuity with related roads;
- The vertical alignment to follow the existing ground as much as possible, to provide direct access to roadside developments;

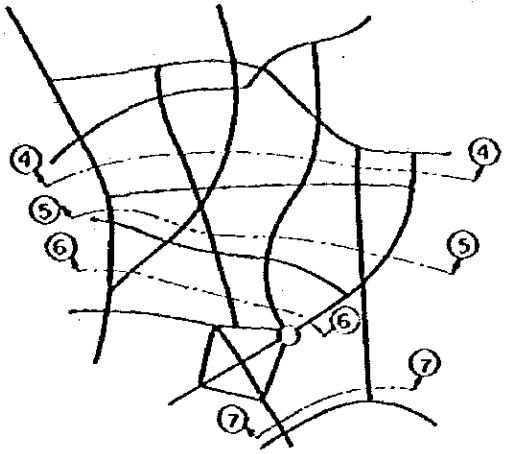
TABLE 6 TRAFFIC VOLUME AND NUMBER OF LANES REQUIRED BY SCREEN LINE



Cross Section	Traffic (100 veh/day) Volume			No. of Lanes Required			No. of Lanes of Each Road			
	1980	1990	2000	1980	1990	2000	o Name of Road	1980	1990	2000
							o C-6	–	S-2 (1.5)	D-2 (4)
							o G. Luis	S-2 (1.5)	S-2	S-2
							o Republic (C-5)	–	D-2 (4)	D-3 (6)
							o Tandang Sora	S-2 (1.5)	S-2 (1.5)	S-2 (1.5)
							o Quirino High way	S-4 (3)	S-4 (3)	S-4 (3)
①-①	91	136	215	9	13	20	Sub-total 1 – 1	8 (6)	14 (11.5)	18 (16)
①'-①'	(162)	(206)	(325)	(15)	(19)	(30)	o EDSA	D-3 (6)	D-4 (8)	D-5 (10)
							TOTAL 1 – 1	14 (12)	22(19.5)	28 (26)
							o C-6	D-2 (4)	D-2 (4)	D-3 (6)
							o Republic (C-5-	–	D-2 (4)	D-3 (6)
							o Tandang Sora	S-2 (1.5)	S-2 (1.5)	S-2 (1.5)
							o Ext. Con- gressional	–	–	D-2 (4)
②-②	36	87	171	4	8	16	o North Ave.	S-2 (1.5)	D-2 (4)	D-2 (4)
②'-②'	(101)	(175)	(291)	(10)	(16)	(27)	Sub-Total 2 – 2	8 (7)	14(13.5)	22(21.5)
							o EDSA	D-3 (6)	D-4 (8)	D-5 (10)
							o West Ave.	S-4 (3)	S-6 (5)	S-6 (5)
							Total 2 – 2	18 (16)	28(26.5)	38(36.5)
							o C-6	–	D-2 (4)	D-3 (6)
							o Republic (C-5)	–	D-2 (4)	D-3 (6)
							o Tandang Sora	S-2 (1.5)	S-2 (1.5)	S-2 (1.5)
							o Don Mariano	D-2 (4)	D-3 (6)	D-4 (8)
③-③	60	112	181	6	11	17	Sub-total – 3	6 (5.5)	16(15.5)	22(21.5)
③'-③'	(143)	(227)	(356)	(13)	(21)	(33)	o EDSA	D-4 (8)	D-5 (10)	D-5 (10)
							Total 3 – 3	14(13.5)	26(25.5)	32(31.5)

o Traffic Capacity of one lane is assumed to be 11,000 veh/day

TABLE 7 TRAFFIC VOLUME AND NUMBER OF LANES REQUIRED BY SCREEN LINE



Cross Section	Traffic (1000 veh/day) Volume			No. of Lanes Required			No. of Lanes of Each Road			
	1980	1990	2000	1980	1990	2000	Name of Road	1980	1990	2000
④–④	73	142	198	7	13	18	o North Expressway	D–2 (4)	D–2 (4)	D–3 (6)
							o Mindanao Ave.	–	S–2 (1.5)	D–2 (4)
							o Quirino Highway	S–4 (3)	S–4 (3)	S–4 (3)
							o Visayas Ave.	–	D–2 (4)	D–2 (4)
							o New Link	–	–	D–2 (4)
							o Don Mariano	D–2 (4)	D–2 (4)	D–3 (6)
							Total 4 – 4	12 (11)	16(15.5)	28 (27)
⑤–⑤	119	214	299	11	20	28	o North Expressway	D–2 (4)	D–2 (4)	D–3 (6)
							o Quirino Highway	S–4 (3)	S–4 (3)	S–4 (3)
							o Mindanao Ave.	–	D–2 (4)	D–3 (6)
							o Visayas Ave.	–	D–2 (4)	D–2 (4)
							o C–5 (Luzon)	–	D–2 (4)	D–3 (6)
							o Don Mariano	D–2 (4)	D–3 (6)	D–4 (8)
							Total 5 – 5	12 (11)	26 (25)	34 (33)
⑥–⑥	191	217	292	18	20	27	o North Expressway	D–2 (4)	D–2 (4)	D–3 (6)
							o Quirino Highway	S–4 (3)	S–4 (3)	S–4 (3)
							o Congressional Ave.	D–2 (4)	D–2 (4)	D–2 (4)
							o Mindanao Ave.	D–2 (4)	D–2 (4)	D–3 (6)
							o Visayas Ave.	D–2 (4)	D–2 (4)	D–2 (4)
							o Don Mariano	D–2 (4)	D–3 (6)	D–4 (8)
							Total 6 – 6	24 (23)	26 (25)	32 (31)
⑦–⑦	109	210	295	10	19	27	o Katipunan	S–2 (1.5)	D–3 (6)	D–4 (8)
							o Moyala Ave. Ext.	D–2 (4)	D–2 (4)	D–2 (4)
							o EDSA	D–5 (10)	D–5 (10)	D–5 (10)
							Total 7 – 7	16(15.5)	20 (20)	22 (22)

- The planning should ensure that all work accomplished in Stage 1 could be utilized in Stage 2; and
- The type of structure, pavement and interchange to be adopted should be based on a comparative analysis of the various types.

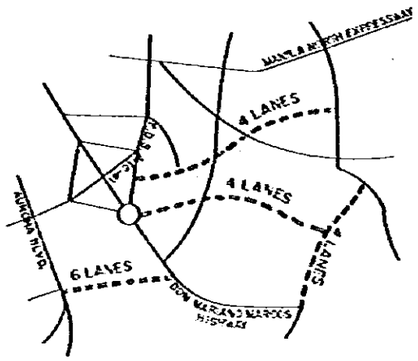
1) Geometric Design Standards

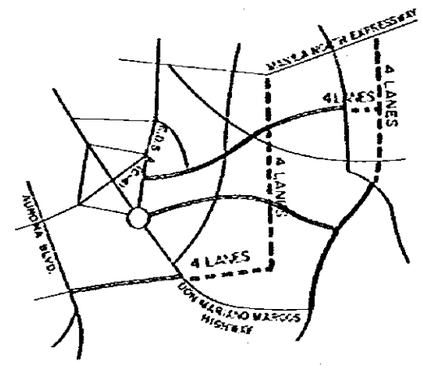
The geometric design standards of each Project Road were established as shown in Table 8.

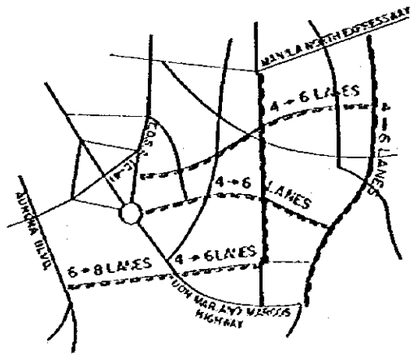
TABLE 8 GEOMETRIC DESIGN STANDARDS

	UNIT	C-5		C-6	MINDANAO & VISAYAS AVENUES
		REPUBLIC AVENUE	OTHER SECTIONS		
Design Speed	kph	80	80	80	60
Right-of-Way Width	M	50	40-60	45	38
Lane Width	M	3.50	3.50/3.25	3.50	3.50/3.25
Bus/Jeepney Land Width	M	3.50	3.25	3.50	3.00
Median Width	M	4.00	4.00/2.50	6.00	3.00
Inner Shoulder Width	M	0.25	0.25	0.25	0.25
Outer Shoulder Width	M	2.00	2.00	2.00	2.00
Outer Shoulder Width (When B/J lane provided	M	0.50	0.25	0.50	0.50
Crossfall of Roadway	%	1.5/2.0	1.5/2.0	1.5/2.0	1.5/2.0
Minimum Radius	M	260	260	260	260
Maximum Superelevation	%	6	6	6	6
Maximum Gradient	%	7	7	7	8
Critical Length of Gradient	M	400	400	400	300

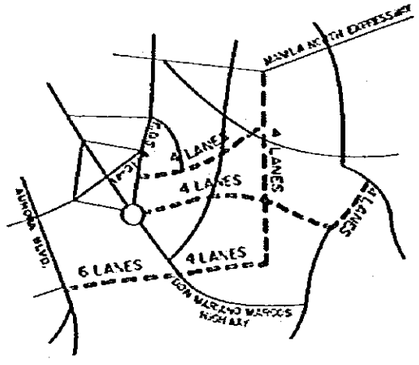
ALTERNATIVE - 2 (B)

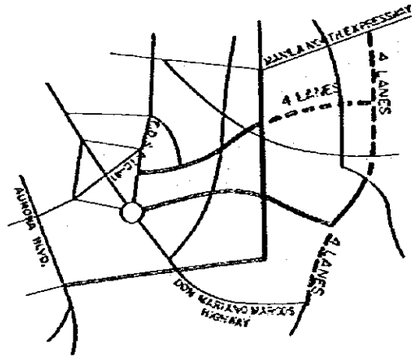




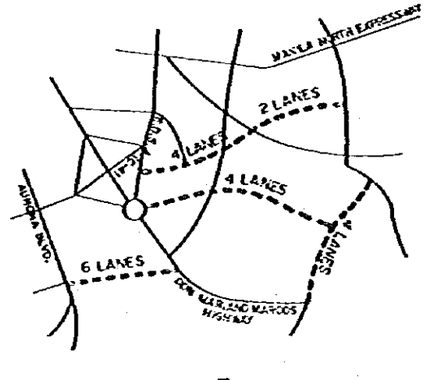


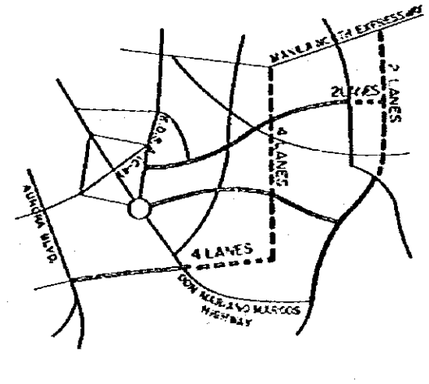
ALTERNATIVE - 2 (A)

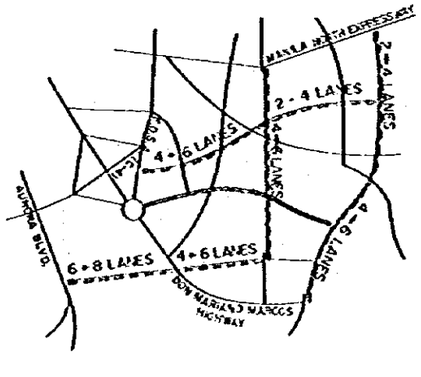




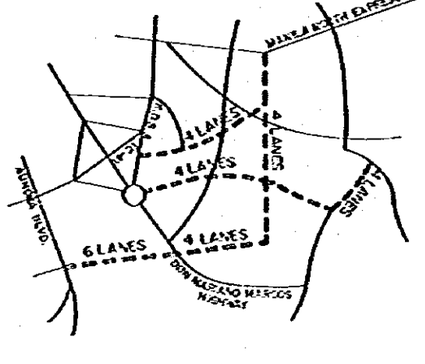
ALTERNATIVE - 1 (B)

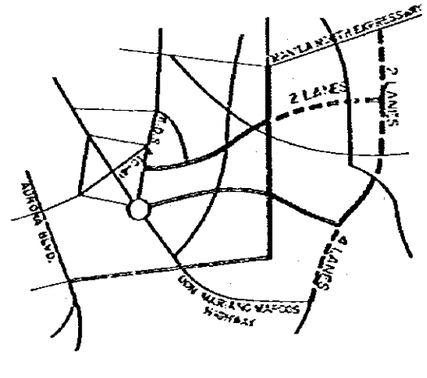






ALTERNATIVE - 1 (A)





PHASE - 1
OPENING YEAR - 1989

PHASE - 2
OPENING YEAR - 1991

STAGE - 1

STAGE - 2
OPENING YEAR - 1997

LEGEND :

- PROJECT ROADS TO BE CONSTRUCTED
- PROJECT ROADS COMPLETED IN THE PREVIOUS STAGE
- PROJECT ROADS FOR WIDENING

: FIGURE 10. ALTERNATIVE PLANS

2) Standard Cross-Section

The elements of the cross-sections for the Project Roads are as follows:

- Lane width shall be 3.5 meters and may be reduced to 3.25 meters when right-of-way is limited;
- Jeepney/bus lanes shall be installed in Stage 2 with a width of 3.5 meters as a principle (3.0 meters minimum);
- The inner shoulder shall be 0.25 meter;
- The outer shoulder shall be 2.0 meters or, where jeepney/bus lane is installed, 0.50 meter. No outer shoulder may be installed when necessary;
- The minimum center median and sidewalk width shall be 2.5 meters and 3.0 meters, respectively; and
- For phasing of construction work from Stage 1 through the final stage, outer lanes (those adjoining the sidewalk) shall be constructed first.

The cross-section of each road at different stages is illustrated in Figure 11.

3) Intersection

Intersections will be either of the following: (See Figure 12).

a) Grade Separation

Intersections between major roads and intersections between a major road and a secondary major road will be built at-grade in Stage–1 and will be upgraded to grade separation in Stage–2.

b) Major At-Grade Intersection

This will allow traffic to proceed to all directions (straight, left, and right) from any of the approach roads. Spacing between these intersections are usually between 500 to 700 meters, with the allowable minimum of 300 meters as a principle.

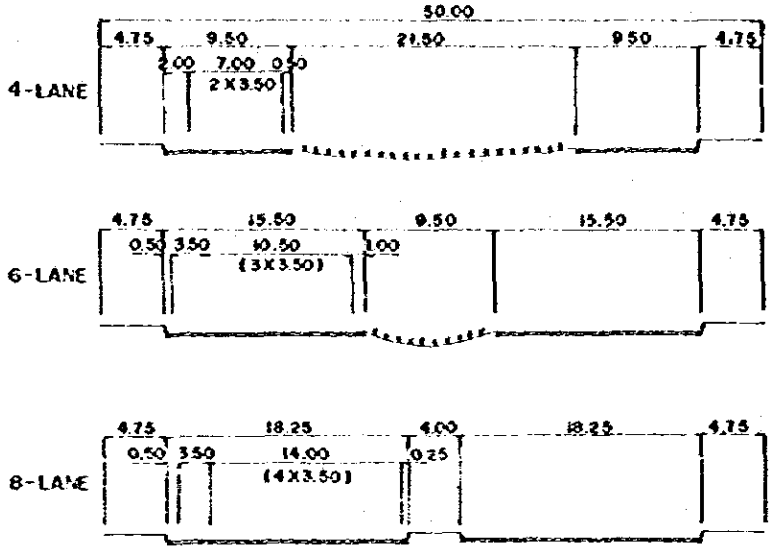
c) Minor At-Grade Intersection

Intersections of the Project Roads with local roads will be of this type, with the center median of the Project Road closed to discourage crossings and that the traffic from the local roads could make right-turn only.

FIGURE 11. STANDARD CROSS-SECTIONS

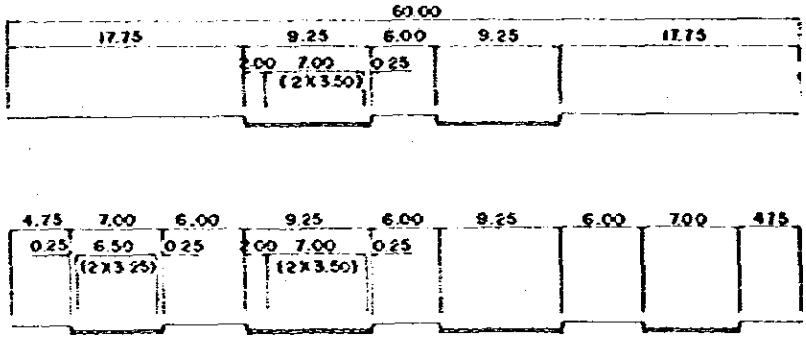
C-5 (REPUBLIC AVE.)

NO. OF LANES	STAGE-1	STAGE-2
ALT.-1	4	6
-2	4	6



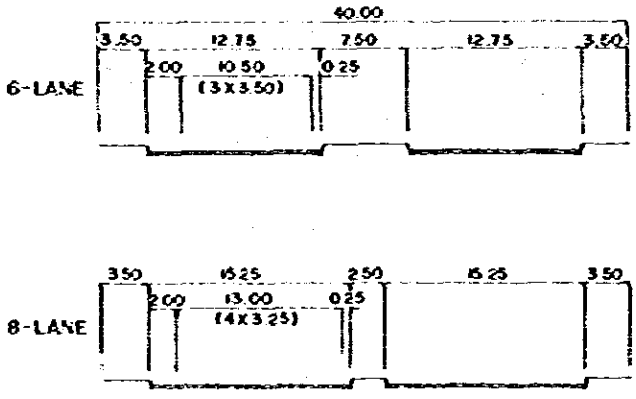
C-5 (LUZON AVE.)

NO. OF LANES	STAGE-1	STAGE-2
ALT.-1	4	6
-2	4	6



C-5 KATIPUNAN AVE

NO. OF LANES	STAGE-1	STAGE-2
ALT.-1	6	8
-2	6	8

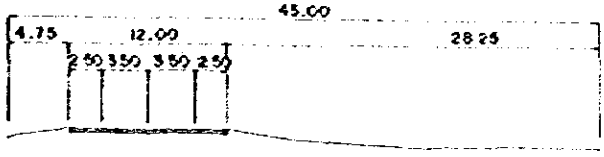


C-6

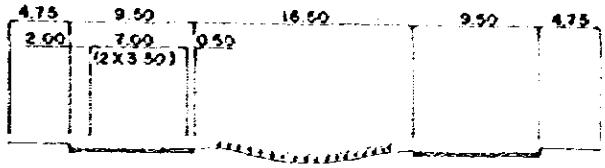
NO. OF LANES

	STAGE-1	STAGE-2
ALT-1	2	4
	4	6
-2	4	6

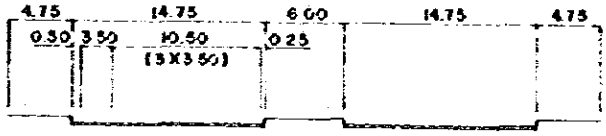
2-LANE



4-LANE



6-LANE

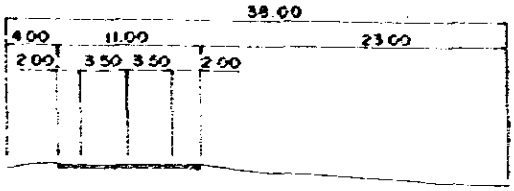


MINDANAO AVE.

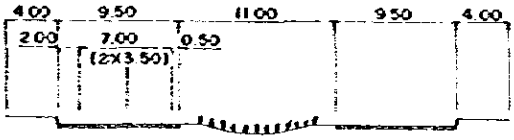
NO. OF LANES

	STAGE-1	STAGE-2
ALT.-1	2	4
	4	6
-2	4	6

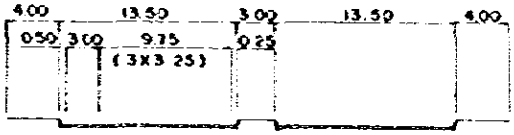
2-LANE



4-LANE



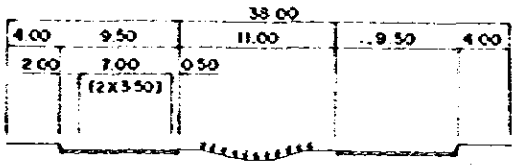
6-LANE



VISAYAS AVE.

NO OF LANES

	STAGE-1	STAGE-2
ALT.-1	4	4
-2	4	6



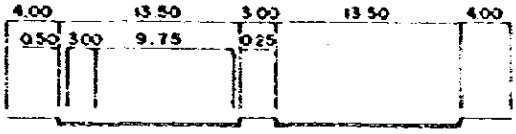
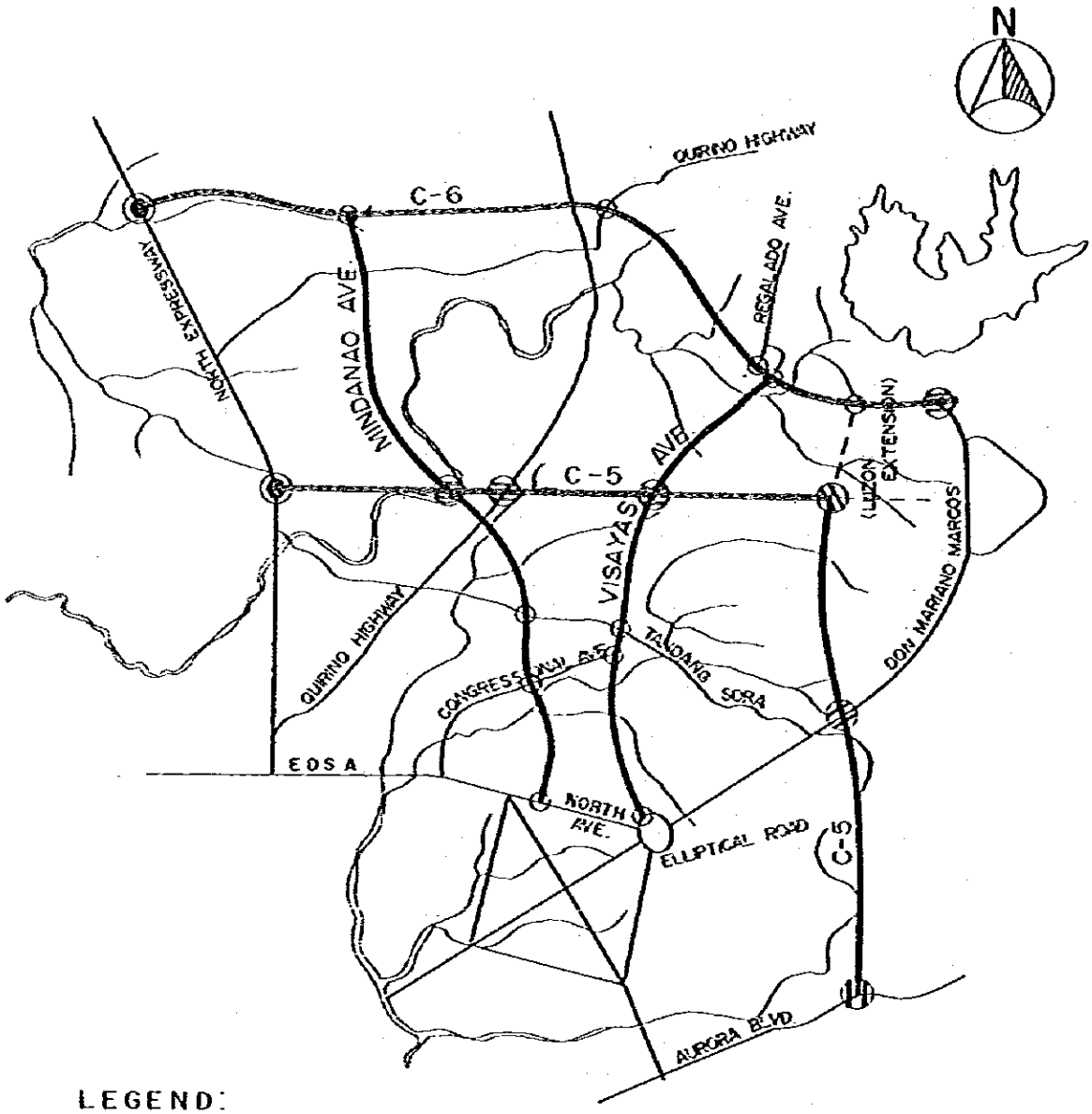


FIGURE 12. LOCATION OF MAJOR INTERSECTION/INTERCHANGE



LEGEND:

- : PROPOSED ROAD
- : EXISTING ROAD
- : INTERCHANGE
- : GRADE SEPARATION
- O : AT — GRADE INTERSECTION (TRAFFIC ANALYSIS MADE)

4) Interchange

Interchanges will be constructed at the intersections of C–5 and C–6 with the MNE, an access-controlled speedway. A double trumpet is recommended in view of its lower construction cost and it conforms with the major traffic flow.

5) Pavement Type

After comparing portland cement concrete pavement with asphalt concrete pavement, the former was selected in preference of its lower maintenance requirement over the lower initial investment cost of the latter.

6) Structures

All structures were designed based on "Standard Specifications for Highways and Bridges (12th Edition, 1977)" and the latest edition of "Interim Specifications for Bridges" released by the American Association of State Highway and Transportation Officials (AASHTO). However, matters not covered by the AASHTO standards were considered based on the standards of the Ministry of Public Works and Highways or those used in Japan.

8. ENVIRONMENTAL IMPACT

1) Prediction and Assessment of the Impacts

The environmental impacts are categorized into pre-construction phase, construction phase and operation phase. The operation phase is further subdivided into direct impact and indirect impact. Figure 13 shows the general environmental impact caused by the implementation of the project roads.

2) Mitigating Measures

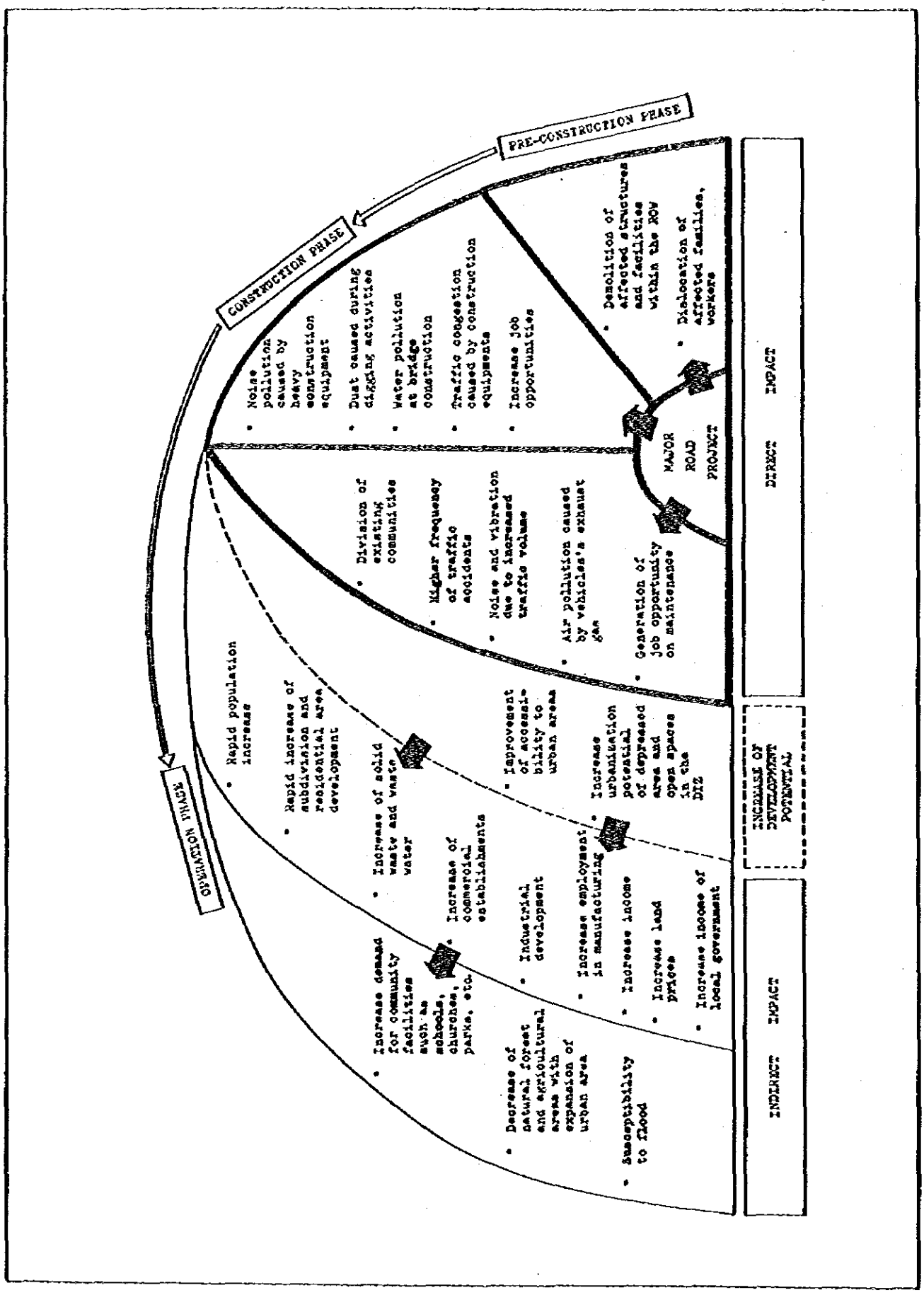
- Affected Families

  For dislocated families, the Government, through the MHS, gives priority to those affected families in subdivisions near the area.

- Demolition of affected structures and facilities

  In the demolition of structures and facilities, the Government should extend assistance in the form of manpower personnel and equipment.

FIGURE 13. GENERAL ENVIRONMENTAL IMPACT CAUSED BY MAJOR URBAN ROAD PROJECT



* Construction Nuisance

The nuisance and inconvenience during construction should be significantly reduced by introduction of proper construction management and supervision and adoption of proper construction equipment and methods.

* Pollution

Noise pollution from traffic is more eminent than other pollutions. This pollution could be mitigated by providing space for planting strip. The land used control through the zoning system is another effective measure and should be introduced along the roads.

* Community Cohesiveness

To maintain the cohesiveness of existing communities, traffic safety devices at strategic points, such as pedestrian crossings with road markings, traffic signs and signals, and pedestrian overpasses are necessary.

* Provisions of utilities and facilities associated with the urbanization caused by the project roads.

The Government, as well as the private sector, should join hands in planning and construction of utilities and facilities, such as water supply, electricity, drainage, sewerage, telecommunication, schools, churches, etc., associated with expected urbanization caused by the project roads.

9. PROJECT COST

The summary of project costs is shown in Table 9.

TABLE 9 SUMMARY OF PROJECT COST

Unit: Million Pesos (May 1982 constant price)

	ALTERNATIVE			
	1 (A)	1 (B)	2 (A)	2 (B)
STAGE 1				
Phase 1				
Foreign	209.34	154.62	211.81	167.36
Local	286.22	240.82	287.41	247.31
Tax	53.97	39.79	54.55	43.04
Total	549.53	435.23	553.77	457.71
Phase 2				
Foreign	48.23	102.94	90.12	134.55
Local	93.18	138.58	114.81	154.90
Tax	12.50	26.69	23.36	34.90
Total	153.91	268.21	228.29	324.35
Sub-Total				
Foreign	257.56	254.56	301.93	301.93
Local	379.40	379.40	402.22	402.22
Tax	66.48	66.48	77.91	77.91
Total	703.44	703.44	782.06	782.06
STAGE 2				
Foreign	211.20	211.20	200.50	200.50
Local	199.28	199.28	113.24	113.24
Tax	53.84	53.84	51.13	51.13
Total	384.32	384.32	364.87	364.87
GRAND TOTAL				
Foreign	468.76	468.76	502.43	502.43
Local	498.68	498.68	515.46	515.46
Tax	120.32	120.32	129.04	129.04
Total	1,087.76	1,087.76	1,146.93	1,146.93

10. PROJECT EVALUATION

1) Economic Analysis

a) Methodology

The procedures for the quantification of benefits that would accrue from the implementation of the project were patterned after the present practice of the MPWH as incorporated in the "Highway Planning Manual" though

with some adjustments to suit present conditions in urban area. The quantified benefits were purely from the savings in traffic costs by comparing the effectiveness of the road network of the DIZ with or without the project roads. The project roads involving mostly new construction on a potential area for urbanization, and their developmental effect were quantified in the form of traffic costs savings from the generated traffic.

b.) Traffic Cost

The basic traffic costs, which are defined as the costs incurred by vehicles using roads in good condition, lane width of at least 3.00 meters, flat gradients and minimum roadside friction, were patterned after the present practice of the MPWH.

The basic traffic costs are presented below:

TABLE 10 BASIC TRAFFIC COSTS

Vehicle Type	Basic Running Costs Vehicle/Km.	Basic Fixed Costs Vehicle/Hour	Basic Passenger Time Costs Vehicle/Hour
Light Car	0.9704	1.74	6.77
Jeepneys	0.6053	9.36	5.62
Large Bus	1.8209	18.70	21.75
Medium Truck	1.6850	15.19	–

c) Benefits

The construction of the project roads which will complete the major roads in the DIZ and make the road network function as a system will change the traffic pattern in the area. When the project roads shall be opened to traffic, there will be a more balanced utilization of road spaces, i.e., roads that are presently under utilized will be having more traffic, the roads that are presently saturated will experience traffic decongestion and the existing sections of the project roads will improve their level of service. The beneficiaries of these effects are:

- Traffic that presently uses the existing sections of the project roads with and without the project. This traffic will experience savings in traffic costs due to improved level of service.

- Traffic that will be attracted to the project roads. This traffic will realize faster travel compared to their old congested and circuitous routes.

- Traffic that would remain on affected major roads. This traffic will enjoy the decongestion effect due to the diversion of some traffic using the existing roads to the project roads.

d) Cost-Benefit Analysis

Each of the alternative plans was subjected to economic analysis using the following assumptions:

- The opportunity cost of capital at 15 percent
- Benefit calculation is 20 years after the construction of Phase I, Stage 1.
- Shadow price of the foreign component by an additional 18%.
- No salvage value to the road structure after the study period.

TABLE 11 ECONOMIC EVALUATION

Alternatives	Net Present Value (₱ Million)	B/C Ratio	IRR (Percent)
Plan 1(A)	1,748.7	4.26	44.9
Plan 1(B)	1,720.5	4.35	46.3
Plan 2(A)	1,763.6	4.10	44.0
Plan 2(B)	1,741.7	4.17	45.2

The tabulation shows that all the Alternative Plans are all economically feasible The degree of viability of all the plans are practically the same.

e) Sensitivity Analysis

A sensitivity test was conducted to determine the risk of the project in terms of the following factors:

1) Construction Cost (+20%)
2) Traffic Volume (±20%)
3) Construction Cost (+20%)
   Traffic Volume (−20%)
4) Discount Rates at 12% and 18%

The result of the sensitivity analysis shows that the priority ranking of the project roads are basically the same with that of the results in the economic evaluation.

2) Financial Analysis

a) General

The published planning manuals of MPWH do not specifically set a guideline on financial analysis of road investment. The analysis, therefore, tries to present a flexible schedule for the implementation of the project (as well as the on-going, committed and/or programmed projects), taking into consideration the resource capability of the government. The financial requirement of the project, which will come from the national infrastructure fund, will be analyzed with the following preparatory procedures:

- A time series simulation of investment cost;
- A possible measurement of financial resources; and
- An analytical appraisal of the first two.

This kind of analysis, however, is rather more analogous to financial programming than financial analysis.

b) Infrastructure Funds of NCR

There are development plans prepared for Metro Manila, composed of the Five-Year Development Plan, 1983-1987 prepared by NEDA, the Regional Development Framework Plan (RDFP) 1983-1992 and the Capital Investment Folio (CIF), 1982-1987, both prepared by the Metro Manila Commission. With the MPWH's Annual Report CY 1979-1981, the Capital Outlay of Highway CY 1981-1986, and the 1983-1987 Infrastructure Program, the NCR financial resources for infrastructure is shown in the Table 12.

c) Highway Funds for NCR

MPWH cash allocation for NCR Highways for 1983-1987 is assumed to increase at the level of 14.3% per annum as disclosed by the Five-Year Plan in its cash disbursement program for infrastructure requirement. Beyond the period of the plan, the ceiling perspective would be drawn within the frame of GNP, GDP, GDP and NCR GRDP where the high and low estimations are based on the GDP growth ratio and NCR GRDP, respectively, as shown in the Table 13.

TABLE 12 NCR FINANCIAL RESOURCES FOR INFRASTRUCTURE

(Million Pesos)

		1983	1984	1985	1986	1987	1983–1987
Low	A	1,970	2,200	2,520	2,840	3,260	12,790
	B	1,790	1,810	1,890	1,940	2,020	9,450
High	A	3,220	3,750	4,390	5,040	5,900	22,300
	B	2,930	3,100	3,300	3,440	3,670	16,440
Average							
	A	2,595	2,975	3,455	3,940	4,580	17,545
	B	2,360	2,455	2,595	2,690	2,845	12,945

Remarks : A is Current Prices
B is 1982 Constant Prices

d) Possible Allocation for the Project

The Table 14 indicates limited funds/requirement vis-a-vis by alternative schemes of the project investment cost. A yearly investment requirement is escalated at 9.5% per annum, as the midpoint of inflation 9% per year estimated in the Five-Year Development Plan 1983-1987 and 10% forecasted in MMC's CIF for the same period.

Based on the low estimation, no schemes are within the estimated allocation. However, only Plan 1 (B) can stay within the high allocation.

3) Traffic Impact

The traffic impacts of the different alternative plans are basically the same, providing a road network that would improve the traffic condition in the area. In year 1989, the proposed opening year of the different alternative plans of Phase 1, Stage 1, the average volume-capacity (V/C) ratio of the road network in the DIZ would improve from 0.88 without Phase 1 to about 0.75. Comparing the different alternatives, Plans 1(B) and 2(B) would provide a more balanced network with a V/C ratio of 0.51 to 0.86 for the project roads and 0.82 to 1.43 for other related roads. Plans 1(A) and 2(A) have high variation in the level of service with 0.39 to 0.91 for the project roads and 0.77 to 1.35 for other related roads. The traffic assessment shows that Plan B would provide a more balanced road network in the DIZ.

TABLE 13 CORRELATION OF FUNDS, REQUIREMENT AND MPWH CASH SUPPORT FOR NCR HIGHWAYS

(Million Pesos)

YEAR	NCR Fund For Infra-structure	NCR Infra-structure Require-ment	Highways Require-ment	MPWH Cash Allocation NCR (In Thousand Pesos)	
1979	--	--	--	171,797 ($4,963)	
1980	--	--	--	134,713 ($2,965)	
1981	--	--	--	207,867 ($2,977)	
1982	--	3,827	201	235,205 ($3,981)	
1983	2,595	6,920	458	340,000 ($4,000)	
1984	2,975	8,203	817	388,620	
1985	3,455	9,531	1,139	444,190	
1986	3,940	11,050	1,354	Low 507,710	High
1987	4,580	11,911	1,234	Estimate 580,320	Estimate
1988	5,086	13,920	1,420	665,970	691,020
1989	5,807	15,892	1,621	760,340	783,190
1990	6,600	18,036	1,842	864,210	884,280
1991	7,385	20,211	2,062	966,970	995,200
1992	8,251	22,581	2,303	1,080,300	1,116,800
1993	9,181	25,126	2,563	1,202,100	1,250,000
1994	10,192	27,894	2,845	1,334,600	1,395,900
1995	11,291	30,901	3,152	1,478,400	1,555,300
1996	12,484	34,166	3,485	1,634,600	1,729,000
1997	13,778	37,708	3,846	1,804,000	1,920,000
1998	15,181	41,549	4,238	1,988,000	2,128,000
1999	16,719	45,759	4,667	2,189,000	2,355,000
2000	18,368	50,271	5,128	2,405,000	2,602,000

Sources:
- Regional Development Framework Plan, 1983–1992. MMC OCP November 1982
- Metropolitan Manila Capital Investment Folio Study, Final Report. MMC OCP November 1982
- MPH Annual Report CY 1979–1981
- MPWH Infrastructure Program CY 1982, September 1981
- 1983 MPWH Infrastructure Program, NCR

TABLE 14 POSSIBLE ALLOCATION FOR THE PROJECT

	Possible Allocation		Requirement			
	Low 1/	High 2/	Plan 1 (A)	1 (B)	2 (A)	2 (B)
1984	39.9	94.6	4.5	4.5	5.3	5.3
1985	55.5	108.2	18.9	7.7	119.2	108.0
1986	64.9	123.6	144.5	118.9	144.9	122.6
1987	63.8	141.3	154.8	122.6	155.4	128.3
1988	69.8	165.2	163.3	162.1	163.8	166.7
1989	79.7	187.9	74.0	123.8	104.7	146.9
1990	90.6	212.9	38.6	82.5	72.2	107.8
1991						
1992						
1993	126.0	298.5	8.6	8.6	8.2	8.2
1994	139.8	332.4	3.1	3.1	3.0	3.0
1995	154.9	369.4	274.8	274.8	260.7	260.9
1996	171.3	409.6	308.4	308.4	292.9	292.9

1/ Based on the low estimate of MMC

2/ Based on the high estimate of MPWH

4) Contribution to Regional Economy

The quantified benefits in the form of vehicle operating costs and passenger time cost have either direct or indirect contribution to the regional and national economy. The direct impact is the savings in fuel consumption (gasoline and diesel) from the running cost of the vehicle operating costs. In 1991, the completion year of Stage 1, fuel saving would amount to about 204,500 and 210,000 barrels for Alternatives 1 and 2, respectively. In terms of monetary value of the savings in fuel consumption, about 60% of the value represents the foreign cost. This foreign cost savings could contribute to the international trade deficit of the country or dollar outflow of foreign currency. The amount of foreign costs savings in the opening year of Stage 1 would amount to about U.S. $10..3 million and expected to increase more than twice after the completion of Stage 2 in 1999. The table below shows the fuel savings of the project by alternative plans.

TABLE 15 FUEL SAVINGS OF THE PROJECT

YEAR	PLAN	PREMIUM Q	GASOLINE A	DIESEL Q	DIESEL A	TOTAL
1989	1A, 2A	19,392 (122.0)	101,809 (61,085)	7,265 (45.7)	22,606 (14,016)	124,415 (75,101)
	1B	15,289 (96.2)	80,271 (48,163)	6,472 (40.7)	20,133 (12,482)	100,404 (60,645)
	2B	15,956 (100.4)	83,767 (50,260)	6,576 (41.4)	20,460 (12,685)	104,227 (62,945)
1991	1	21,082 (132.6)	110,679 (66,407)	11,435 (71.9)	35,552 (22,042)	146,231 (88,449)
	2	22,341 (140.6)	117,296 (70,378)	11,055 (69.6)	33,045 (20,488)	150,341 (90,866)
1977	1	27,928 (175.7)	146,620 (87,972)	16,696 (105.0)	51,920 (32,190)	198,540 (120,162)
	2	29,620 (186.4)	155,503 (93,302)	18,485 (116.3)	57,482 (35,639)	212,985 (128,941)

Q : Quantity; Thousand liters (thousand barrels)

A : Amount ; In thousand pesos, 1982 market price
( ) Foreign portion

From the tabulation, Plan 2 shows a higher contribution to the national economy.

5) Conclusion

On the basis of the results of the project evaluation, the different alternative plans could be arranged according to their rank on each of the criteria used in the evaluation as shown below:

TABLE 16 PRIORITY RANKING OF ALTERNATIVE PLANS

CRITERIA	Plan 1(A)	1 (B)	2 (A)	2 (B)
a) Economic Evaluation	2nd	1st	4th	3rd
b) Financial Assessment	3rd	1st	4th	2nd
c) Traffic Impact	4th	2nd	3rd	1st
d) Contribution to the National Economy	4th	3rd	2nd	1st

The tabulation shows that Plans 1(B) and 2(B) are the most viable plans for the project. If the criteria used were given weights, the most important would be the financial assessment, followed closely by the economic evaluation, then the contribution to the national economy and the traffic impact in that order. In the economic assessment, Plan 1(B) is the first priority, though the other three are not far behind. In terms of financial assessment, only Plan 1(B) satisfies the high estimates of the annual possible allocation for the project. Furthermore, if the cash flow of the investment up to the completion of Stage 2 in current prices, including escalation, were converted to present values using a discount rate of 15%, the present opportunity cost of capital in the country, Plan 1(B) would be about ₱46.7 million less than Plan 2(B). This difference in the total capital investment could be utilized for other developmental projects. For the last two criteria, where Plan 2(B) obtained the first priority, Plan 1(B) or the other two remaining plans would offer basically the same impact as Plan 2(B).

In view of the above, it could clearly be concluded that Plan 1(B) would provide the greatest overal impacts to the region as well as to the nation in general.

11. PROJECT IMPLEMENTATION

The evaluation of the project roads recommended Alternative 1(B), as the most advantageous plan and on this basis, the following is the proposed implementation program.

1) Detailed Engineering

The detailed engineering design for Stage 1, which will require 16 months, should be undertaken at the earliest possible time, taking into consideration the ultimate stage features, to avoid as much as possible, double investment during the succeeding stages.

Stage 2 construction includes widening of roadways as well as construction of grade separation at major intersections. Therefore, the projected traffic demand in this Study should be re-assessed during the operational phase of Stage 1. Sixteen-month period will be required to complete the design in this Stage.

The detailed engineering costs at 1982 price were estimated as follows:

TABLE 17 DETAILED ENGINEERING COST

Unit: Million Pesos

	Foreign	Local	Tax	Total
Stage 1	7.54	3.39	1.64	12.57
Stage 2	6.34	2.85	1.38	10.57

2) Right-of-Way and Property Acquisition

Since land acquisition can be a serious obstacle to road construction in urban areas, MPWH's close contact with and full coordination with relevant offices of Quezon City, Caloocan City and Municipality of Valenzuela, as well as the Human Settlements Regulatory Commission, MHS, and the Metro Manila Commission, be maintained to enforce strict control over the development activities on and along the proposed routes of the project roads.

The full road right-of-way width of the ultimate stage should be acquired in Stage 1. After the limits of the right-of-way had been established during the detailed engineering phase, land and property acquisition should start for the road sections included in Plan 1(B).

Estimated cost of land and property acquisition were estimated as follows:

TABLE 18 LAND AND PROPERTY ACQUISITION COST

(1982 Price)

Phase 1	161.50 million pesos
Phase 2	85.44 million pesos
Total	246.94 million pesos

3) Construction

The Project should be implemented in two (2) stages, namely Stages 1 and 2. Stage 1 involves the construction of the project roads with minimum improvement, 6 lanes for the Katipunan Avenue and 2 to 4 lanes to the remaining projects just enough to service the traffic demand in the area for the next five years. Stage 2 involves the upgrading and widening of the project roads including grade separation on selected major intersections.

Stage 1 will be further sub-divided into Phases 1 and 2. In Phase 1, radial roads will first be developed, then the rest of the Project Roads will be constructed in Phase 2. Immediately after the completion of Phase 1, Phase 2 will follows.

Estimated construction costs were shown in the Table 19.

4) Fund Preparation

a) Foreign Funds

Financial assistance from a foreign country or an international financing institution will be necessary. The estimated amounts of foreign loans which are equivalent to the foreign currency component, were shown in the Table 20.

TABLE 19 CONSTRUCTION COSTS

Million pesos (1982 Price)

	FOREIGN	LOCAL	TAX	TOTAL
Stage 1				
Phase 1	138.21	71.94	36.22	246.37
Phase 2	96.73	50.35	25.34	172.42
Sub-Total	234.94	122.29	61.56	418.79
Stage 2	192.16	110.71	49.71	352.58
TOTAL	427.10	233.00	111.27	771.37

TABLE 20 FOREIGN FUND REQUIREMENT

(1982 Price)

	MILLION ₱	(MILLION $)
STAGE 1		
Detailed Engineering	7.54	(0.88)
Phase 1 Construction	138.21	(16.17)
Phase 2 Construction	96.73	(11.32)
Phase 1 Supervision	8.87	(1.04)
Phase 2 Supervision	6.21	(0.73)
Sub-Total	257.56	(30.14)
STAGE 2		
Detailed Engineering	6.34	(0.74)
Construction	192.16	(22.48)
Supervision	12.70	(1.49)
Sub-Total	211.20	(24.71)
GRAND TOTAL	468.76	(54.85)

b) Local Funds

The Government should make available the following local funds to implement the Project.

TABLE 21 LOCAL FUND REQUIREMENT

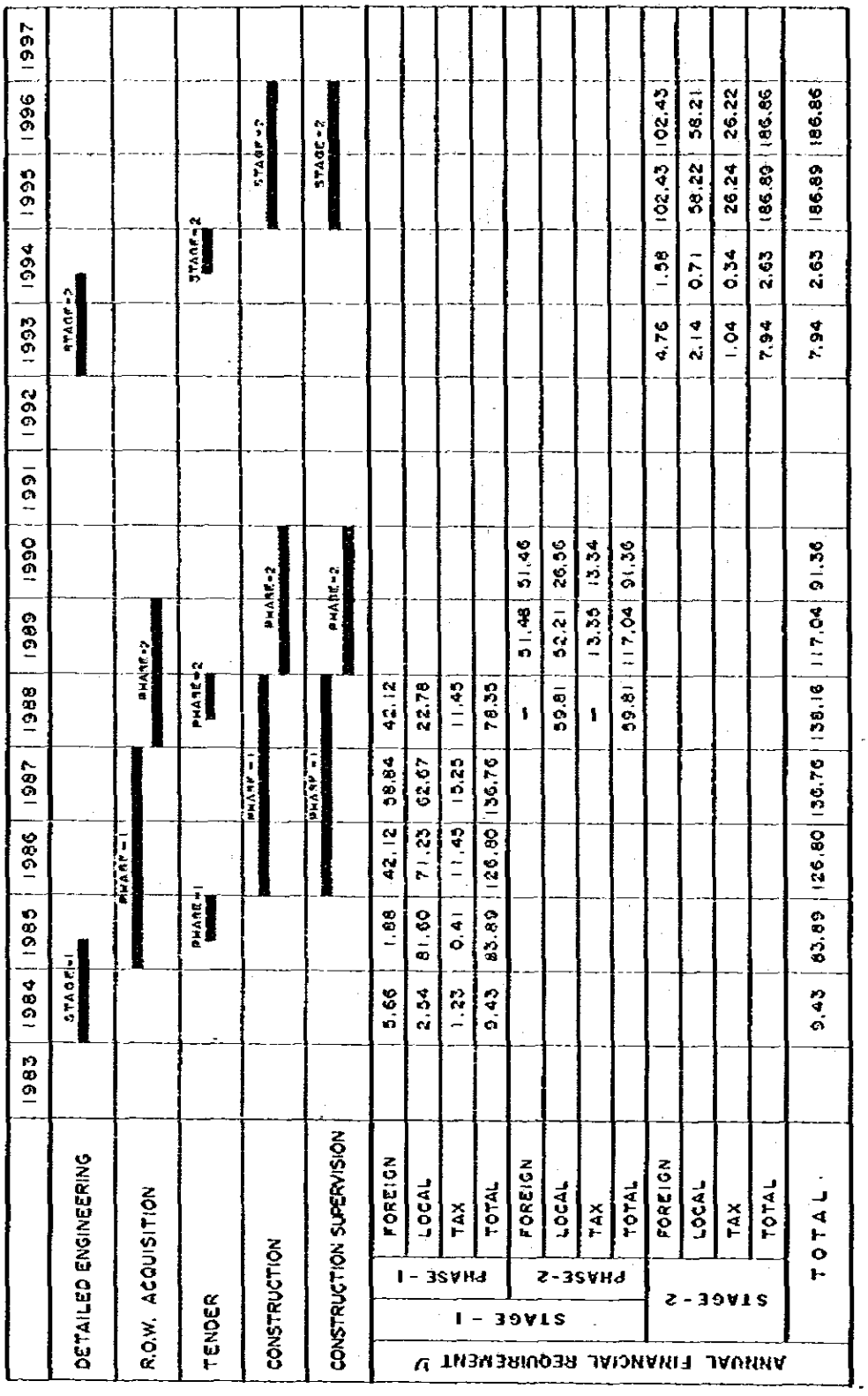
Unit : Million (1982 Price)

	LOCAL CURRENCY COMPONENT	TAX	TOTAL
STAGE 1			
Phase 1			
Detailed Engineering	3.39	1.64	5.03
Right-of-Way Acquisition	161.50	–	161.50
Construction	71.94	36.22	108.16
Supervision	3.99	1.93	5.92
Sub-total	240.82	39.79	280.61
Phase 2			
Right-of-Way Acquisition	85.44	–	85.44
Construction	50.35	25.34	75.69
Supervision	2.79	1.34	4.13
Sub-total	138.58	26.69	165.27
Sub-Total			
Detailed Engineering	3.39	1.64	5.03
Right-of-Way Acquisition	246.94	–	246.94
Construction	122.29	61.56	183.85
Supervision	6.78	3.28	10.06
TOTAL	379.40	66.48	445.88
STAGE 2			
Detailed Engineering	2.85	1.38	4.23
Construction	110.71	49.71	160.42
Supervision	5.72	2.75	8.47
TOTAL	119.28	53.84	173.12
GRAND TOTAL			
Detailed Engineering	6.24	3.02	9.26
Right-of-Way Acquisition	246.94	–	246.94
Construction	233.00	111.27	344.27
Supervision	12.50	6.03	18.53
TOTAL	498.68	120.32	619.00

5) Implementation Schedule

Based on the previous discussion in this Chapter, the overal implementation schedule was developed as shown in Figure 14.

FIGURE 14. IMPLEMENTATION SCHEDULE



CHAPTER 1 INTRODUCTION

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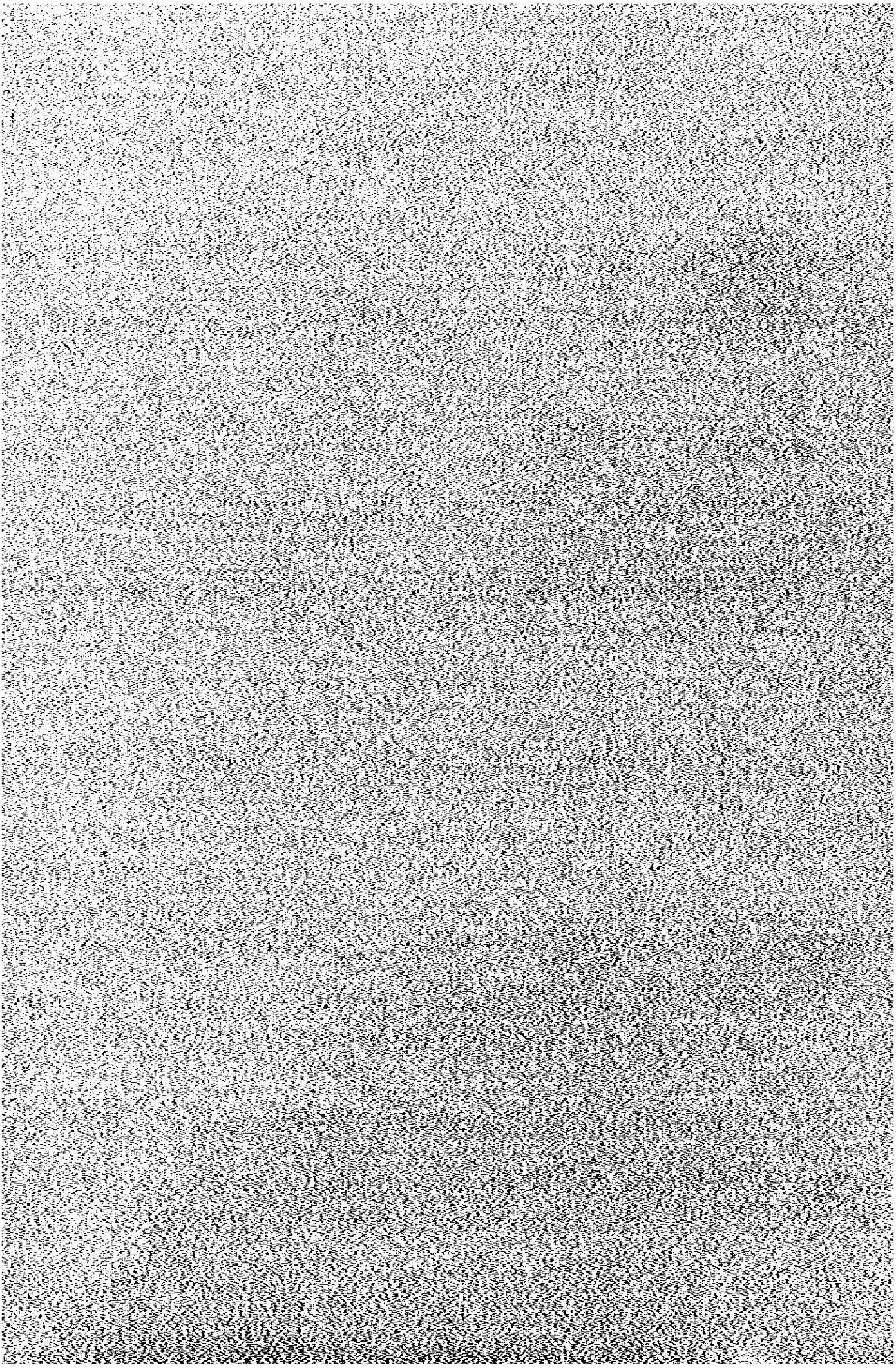

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

The Philippine Government has envisaged various transport plans to relieve Metro Manila of unfavorable traffic conditions suppressing its important functions in its regional and national economy. These plans, which are composed of traffic management and construction of roads, were short or medium range programs to guide transport investment operation within a context of rational land use pattern. The implementation of these plans is expected to improve the movement of goods and people in the area and at the same time promote an orderly land use pattern in accordance with the development strategy for Metro Manila.

Among the major highways recommended for implementation, the major roads located within the inner area (inside Circumferential Road 4 also known as EDSA) are either completed, under construction or are being programmed for implementation. The major roads outside EDSA that were given high priority for implementation are the "Metro Manila Outer Major Roads Projects". The roads south of EDSA were subjected to a detailed feasibility study in 1980-1981 by the Ministry of Public Works and Highways (MPWH) with technical assistance from the Japan International Cooperation Agency (JICA) entitled "Metro Manila Outer Major Roads Project, Southern Package". In response to another request of the Government of the Philippines (GOP), JICA is again extending technical assistance for the conduct of the Feasibility Study for the Metro Manila Outer Major Roads Project, Northern Package.

1.2 OBJECTIVES OF THE STUDY

The Study aims principally to determine the technical, economic and financial feasibility of the construction of the roads included in the Northern Package in accordance with the accepted standards of international financing institutions. The Study will include the following roads and their related intersections:

Project Roads:

1) Circumferential Road 5 (C–5) from the Manila North Expressway in Torres Bugallon, Valenzuela to Aurora Boulevard (R–6), in Quezon City via Republic Avenue and Katipunan Avenue, about 15 kilometers in length.

2) Circumferential Road 6 (C–6) from the Manila North Expressway in Meycauayan, Bulacan to the Don Mariano Marcos Avenue (R–7), in Quezon City, about 12 kilometers in length.

3) Mindanao Avenue from North Avenue in Quezon City to Circumferential Road 6 (C–6), about 9 kilometers in length.

4) Visayas Avenue from Elliptical Road in Quezon City to Circumferential Road 6 (C–6), about 8 kilometers in length.

Intersections:

1) Along Circumferential Road 5 (C–5)

   a) Manila North Expressway
   b) Mindanao Avenue
   c) Quirino Highway
   d) Visayas Avenue
   e) Don Mariano Marcos Avenue
   f) Aurora Boulevard

2) Along Circumferential Road 6 (C–6)

   a) Manila North Expressway
   b) Mindanao Avenue
   c) Quirino Highway
   d) Visayas Avenue
   e) Don Mariano Marcos Avenue

3) Along Mindanao Avenue

   a) Tandang Sora Avenue
   b) North Avenue

4) Along Visayas Avenue

   a) Tandang Sora Avenue
   b) Elliptical Road

1.3 EXECUTION OF THE STUDY

1.3.1 Overall Organization of the Study

The Study was undertaken by a Team composed of a Japanese Consultant from JICA and the Counterpart members from the Urban Road Projects Office of the Ministry of Public Works and Highways (MPWH). The Study Team was guided by an Inter-agency Steering Committee of the GOP and the Supervisory Committee of the GOJ. The Steering Committee members are not only from MPWH but also from the Ministry of Human Settlements, Ministry of Transportation and Communications, Metro Manila Commission and Quezon City.

Most of the work for the Study was done in the Philippines up to the completion of the Draft Final Report, while the preparation of the Final Report was done in Japan based upon the comments of the Steering and the Supervisory Committees on the Draft Final Report. The rationale for the longer stay of the Japanese Consultants in the Philippines is to enable the transfer of technology from the Japanese Consultants to the local Counterpart Team.

Members of the Steering Committee, the Supervisory Committee, the Japanese and their Local Counterpart Study Team are listed in Figure 1.3–1 and Table 1.3–1 to 1.3–4.

1.3.2 Study Approach

General Procedure

The general procedure to achieve the objective of the Study based on the agreed terms of reference between the JICA mission and the Philippine side in February 1982 is illustrated in the flow diagram shown in Figure 1.3–2 and briefly discussed in Table 1.3–5. The following are the principal activities of the Study:

1) Future Framework and Land Use Plan
2) Traffic Analysis
3) Establishment of Candidate Routes and Selection of Alternative Road Network
4) Preliminary Design
5) Impact Study on the Social and Natural Environment
6) Evaluation of the Project
7) Financial Analysis
8) Preparation of Implementation Program

FIGURE 1.3-1 OVERALL ORGANIZATION OF THE STUDY

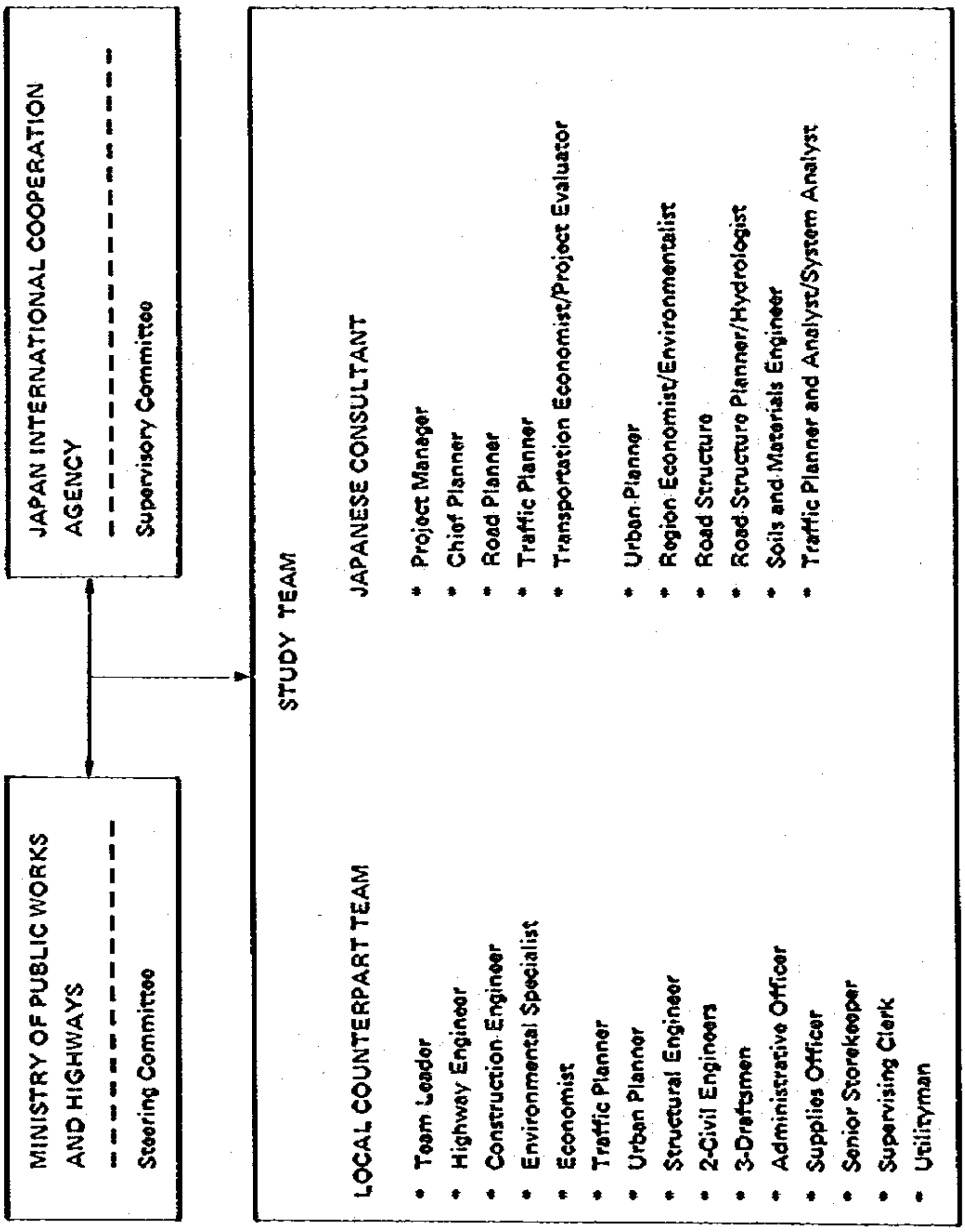

TABLE 1.3-1 STEERING COMMITTEE MEMBERS

Chairman	:	Teodoro T. Encarnacion	Assistant Minister for Planning, Ministry of Public Works and Highways
Member	:	Nathaniel Von Einseidel	Commissioner for Planning, Metro Manila Commission
Member	:	Jose R. Valdecañas	Assistant Minister, Ministry of Transportation and Communications
Member	:	Exequiel Gumayan	Chief, Planning Service, Ministry of Public Works and Highways
Member	:	Rosalio Mallonga	Director, Bureau of Design, Ministry of Public Works and Highways
Member	:	Teodoro T. Gutierrez	Project Manager V, Urban Road Projects Office, Ministry of Public Works and Highways
Member	:	Christine Reyes	Project Manager, Ministry of Human Settlements
Member	:	Gerardo Magat	Project Manager, Office of the Mayor, Quezon City
Member	:	Tateo Ashimi	JICA Consultant, Planning and Project Development Office, Ministry of Public Works and Highways

TABLE 1.3-2 SUPERVISORY COMMITTEE MEMBERS

Chairman	:	Hideaki Araki	Senior Engineer of the City Planning Division, City Bureau, Ministry of Construction (MOC)
Member	:	Shinichi Ishikawa	Planning Officer of the General Affairs Division, Planning Bureau, MOC
Member	:	Shigeaki Matsubara	Deputy Director of the Urban Renewal Division, City Bureau, MOC
Member	:	Tetsuro Nagase	Deputy Director of the International Affairs Division, Planning Bureau, MOC
Member	:	Takaaki Nanbu	Director of the Road Maintenance Section, Road Division, Horukiku Regional Construction Bureau, MOC
Coordinator	:	Gou Nishibe	Development Survey Division, Social Development Cooperation Department, Japan International Cooperation Agency

TABLE 1.3-3 JAPANESE STUDY TEAM MEMBERS

Team Leader	:	Hirokazu Ito	Project Manager
Team Member	:	Shigeru Iwama	Chief Planner
Team Member	:	Mitsuo Hatakeyama	Road Planner
Team Member	:	Kenji Funaki	Traffic Planner
Team Member	:	Masaaki O'hashi	Transportation Economist/ Project Evaluator
Team Member	:	Nobuho Sone	Urban Planner
Team Member	:	Kouichi Kaneko	Region Economist/ Environmentalist
Team Member	:	Takashi Yoshikawa	Road Structure Planner/ Hydrologist
Team Member	:	Tsuneo Kobuchi	Soils and Materials Engineer
Team Member	:	Kazuhiro Hasegawa	Traffic Planner and System Analyst

TABLE 1.3-4 LOCAL COUNTERPART TEAM MEMBERS

Team Leader:	Godofredo Z. Galano	Project Manager
Team Member:	Elisa P. Joson	Highway Engineer
Team Member:	Rodolfo Z. Serdeña	Construction Engineer
Team Member:	Linda M. Templo	Environmental Specialist
Team Member:	Carlota V. Contreras	Economist
Team Member:	Malaquias L. Santos	Traffic Planner
Team Member:	Bienvenida A. Firmalino	Urban Planner
Team Member:	Carlos Rodriguez	Structural Engineer
Support Staff:		
	Paulino B. Badiflo	Civil Engineer
	Luz B. Barnachea	Civil Engineer
	Eden N. Abecilla	Technical Researcher
	Benilda S. Belen	Technical Researcher
	Nora O. Samantila	Draftsman
	Alfredo R. Reyes	Draftsman
	Bibiano D. Calanog	Draftsman
Administrative Staff:		
	Enya A. Bacani	Administrative Officer II
	Oscar G. Tatlonghari	Supplies Officer
	Efren M. Mindo	Senior Storekeeper
	Avelina V. Acorda	Supervising Clerk I
	Fe Alcala	Janitress

The technology transfer was achieved through the on-job trainings and periodical meetings between the Japanese staff and the local counterpart staff.

FIGURE 1.3-2 THE FLOW OF THE FEASIBILITY STUDY WORK

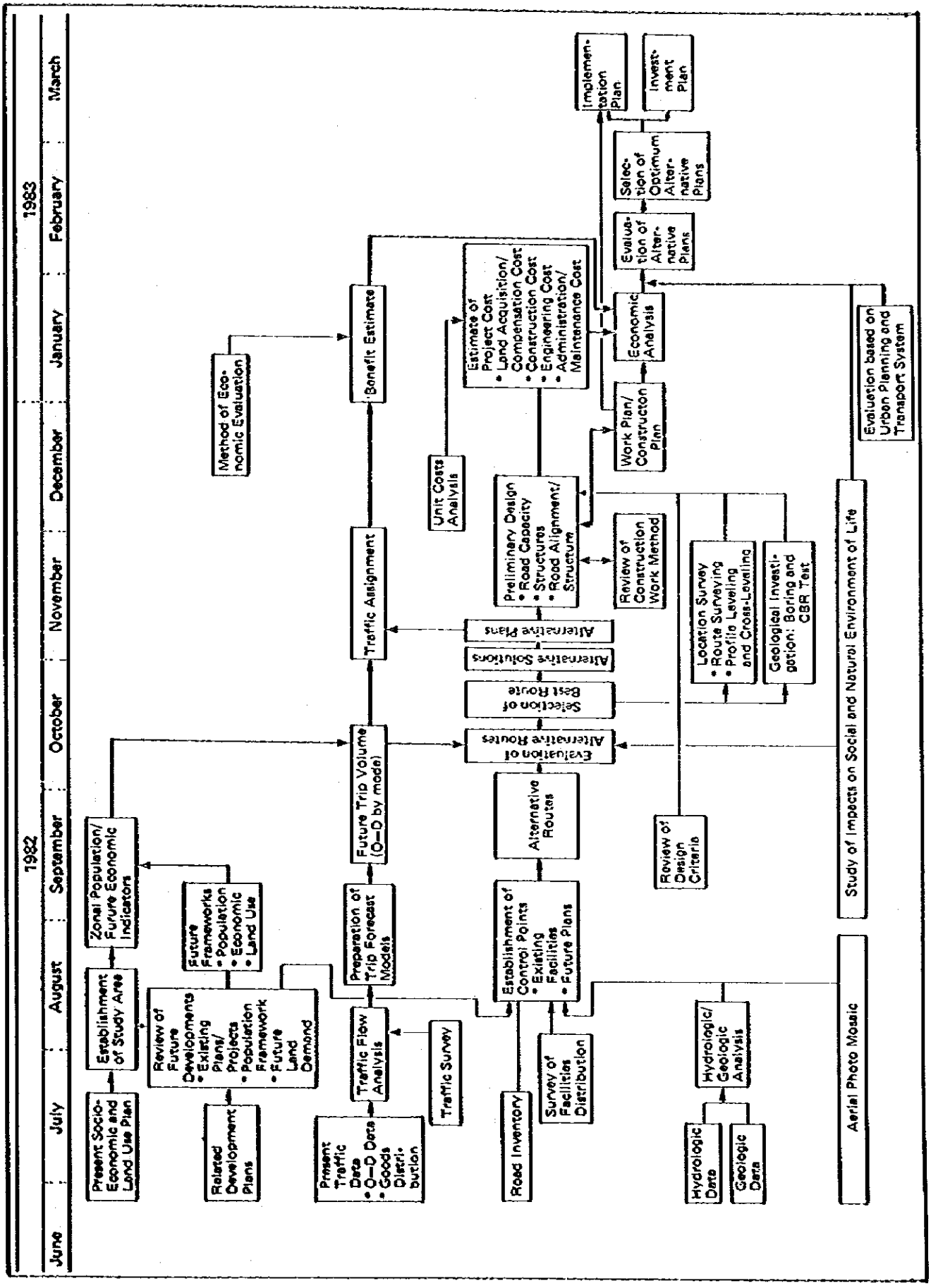

TABLE 1.3–5 A SUMMARY OF THE STUDY WORK

Work Item	Description of Item	Major Output	Major Data to be Used
Future Framework and Land Use Plan	o Review of regional development plans o Review of land use plans o Analysis of time series of demographic data and economic indicators o Future population distribution in accordance with land uses	o Future land use map for the direct influences zones (target year: 1990, 2000) o Future demographic and economic indicators for Metro Manila o Future population by traffic zone	o Land use plans by MHS and MMC o Aerial photo mosaic picture (1/5,000 scale) o NEDA's future frameworks (population, economical indices)
Traffic Forecast	o Preparation of trip generation/attraction, trip distribution, modal split and trip assignment models o Forecast of future traffic volume by 4-step method o Forecast of traffic volume under eahch alternative plan	o Future O-D tables (1990, 2000) o Future traffic volume by link of each alternative plan o Future traffic flow at intersections	o O-D survey of MOTC in 1980 o Demographic indices by traffic zone o Road inventory
Establishment of Alternative Plans and Selection of the Best Route	o Establishment of alternative routes o Comparative evaluation of alternative routes o Study of road cross section, stage construction of project road and types of intersections	o Future roles of C-5 and C-6 o Best routes o Alternative plans for the selected route	o Land use plan o Aerial photo mosaic pictures (1/25,000, 1/5,000 scale) o Geographical map (1/10,000 scale)
Preliminary Design/ Project Cost	o Establishment of design criteria o Route design, pavement design, intersection design and design of ancillary facilities o Hydrologic analysis and bridge design o Work method, construction period o Project cost estimate	o Horizontal and vertical alignments o Road structure o Design of structures o Work plan o Project cost of each alternative plans	o Aerial photo mosaic pictures (1/25,000, 1/5,000 scale) o Geographical map (1/10,000 scale) o Topographic survey data o Geological survey data o Construction materials data
Impact on Social/Natural Environment	o Impact quantification procedures o Prediction and assessment of project impacts o Study of countermeasures	o Geographical delineation of area for the impact study o Mitigating measures o Degree of impacts after such measures	o Future traffic volume o Future land use plan o NEPC guideline
Economic Evaluation of the Project	o Types of benefits and techniques for the quantification of benefits under "di Method" o Economic cost and benefit analysis o Economic evaluation, sensitivity analysis o Selection of the most economical plan	o Economic evaluation of each alternatives (NPV, IRR, B/C) o Priority rankings of alternatives based on the result of sensitivity analysis o Selection of the best alternative	o Project costs o Future traffic volumes by alternatives
Financial Analysis	o Infrastructure investment in Metro Manila Budget for road construction project o Examination of investment funds for the project	o Necessity of international financial assistance and the amount needed o Project implementation program	o Yearly data of budget for road construction o Future investment in road construction projects
Project Implementation Program	o Packaging of projects and construction schedule o Regional development schedule and construction schedule o Review of possible problems in project implementation	o Construction schedule o Funding requirements o Recommendations on road administration/ maintenance	o Organization of MPWH o Road administration/maintenance data

1.4 THE STUDY AREA AND THE DIRECT INFLUENCE ZONE

1.4.1 Study Area

The Study Area is defined as the area in which

1) Socio-economic activities are linked with the project roads.
2) Locations of developmental projects are related with the project roads.
3) Traffic demand distribution is affected by the project roads.

The project roads, generally located in Quezon City, where rapid urbanization is taking place, will not only form part of the radial and circumferential road network in the National Capital Region (NCR) but will also serve Bulacan and Rizal Provinces.

Thus, the Study Area is defined to cover the entire of the NCR and seven (7) municipalities in Bulacan Province and five (5) in Rizal Province. These cities and municipalities are all within the 30-kilometer radius from Manila City, the major Central Business District of NCR. (See Figure 1.4–1)

1.4.2 Direct Influence Zone (DIZ)

The Direct Influence Zone (DIZ) is defined as the area where the socio-economic activities and traffic demand are directly influenced by the Project Roads. The DIZ was studied more in detail than the rest of the Study Area. Accordingly, the land use plan was formulated and subdivided into smaller traffic zones.

The criteria for the establishment of the DIZ are as follows:

1) The municipality or the city where the Project Roads are located;
2) The municipality or the city where the socio-economic activities and traffic demand are directly influenced by the Project Roads; and
3) The municipality or the city where the land use and/or the development plans are strongly linked with the Project Roads.

The DIZ, which was defined based on the above criteria, is composed of two (2) cities and six (6) municipalities, namely, Quezon City, Caloocan City, Marikina, Valenzuela, Navotas, Malabon, Meycauayan and Marilao. (See Figure 1.4–1)

1.4.3 Project Area

The project area is defined as the area along the project roads whose developments are directly dependent on the existence of the project bounded by MNE, EDSA, Aurora Boulevard, Marikina River and C–6.

FIGURE 1.4-1 MAP OF THE STUDY AREA AND DIZ