

REPUBLIC OF THE PHILIPPINES
MINISTRY OF PUBLIC WORKS & HIGHWAYS

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

FINAL REPORT
(SUMMARY)

JUNE, 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

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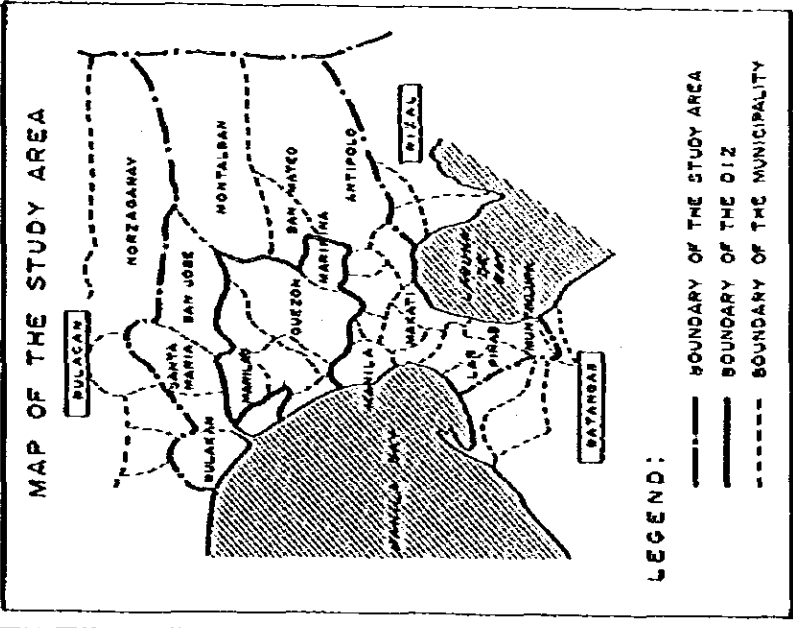
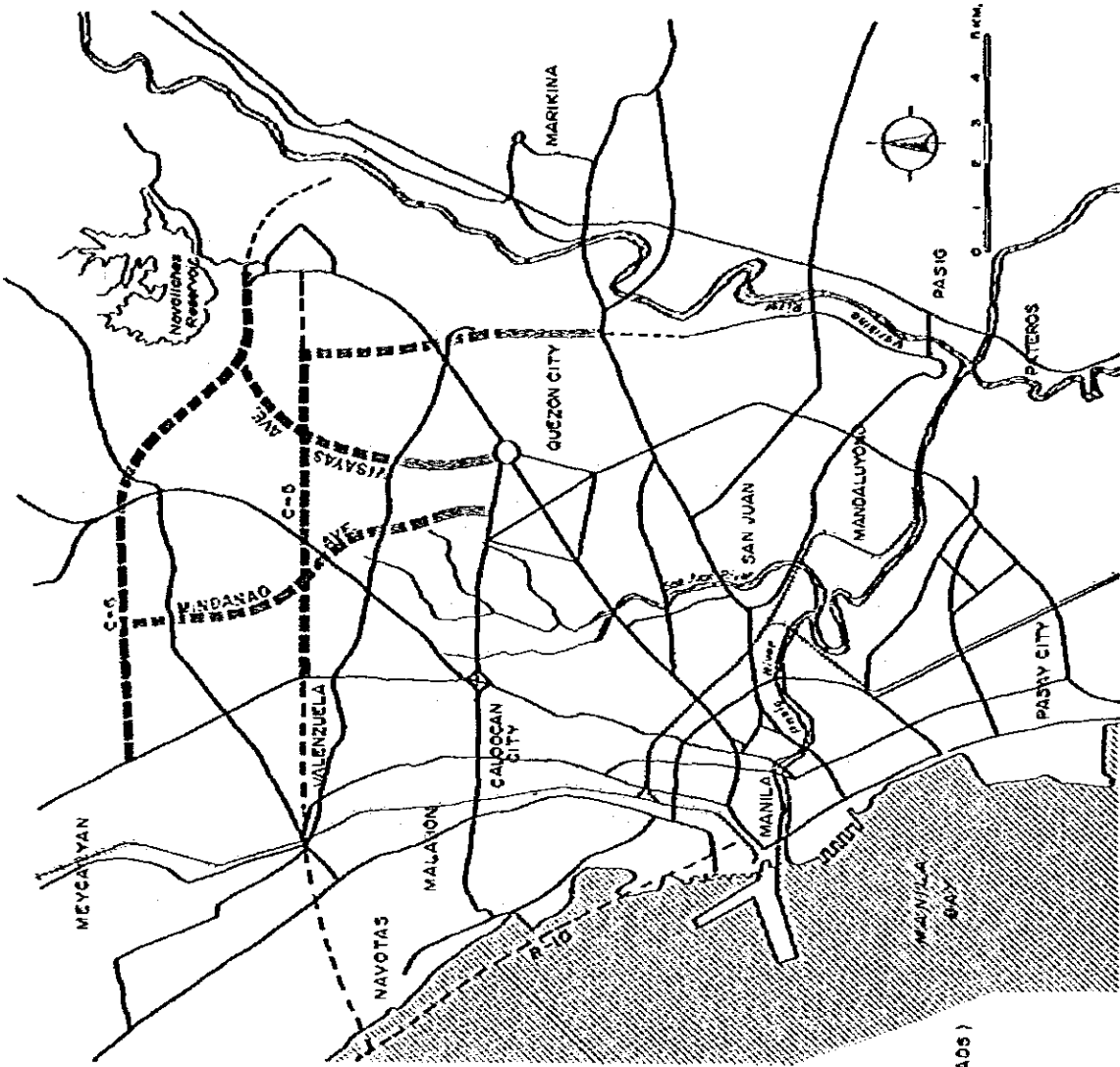
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国際協力事業団	
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PROJECT LOCATION MAP



- LEGEND:**
- ▬▬▬▬▬ PROJECT ROADS (NEW CONSTRUCTION)
 - ▬▬▬▬▬ PROJECT ROADS (IMPROVEMENT OF EXISTING ROADS)
 - - - - - OTHER EXPECTED TRUNK ROADS
 - — — — — EXISTING ROADS

PREFACE

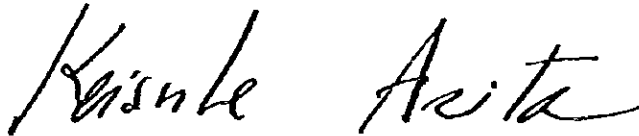
In response to the request of the Government of the Republic of the Philippines, the Government of Japan decided to conduct a feasibility study on the Metro Manila Outer Major Roads Project (Northern Package) and entrusted it to the Japan International Cooperation Agency (JICA). The JICA sent to the 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
President

Japan International Cooperation Agency

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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 Develop-
ment 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

SO₂: Sulfur Dioxide
Sq.M: Square Meter

T

TEAM: Traffic Engineering and Management

U

UNDP: United Nation Development Project

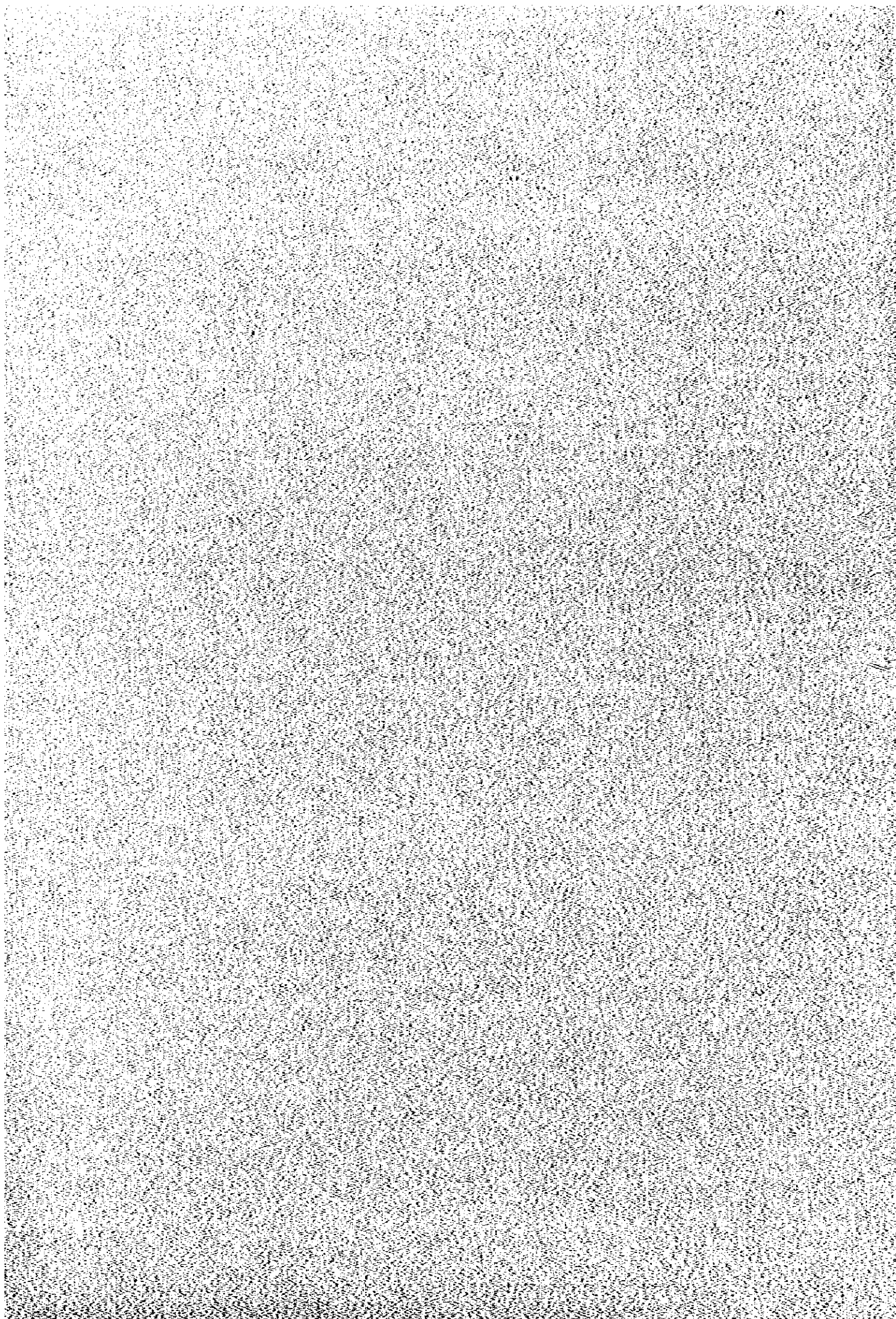
URPO: Urban Road Projects Office

UTSMMA: Urban Transportations Study for Metropolitan Manila

V

V/C Ratio: Volume/Capacity ratio

A. CONCLUSION



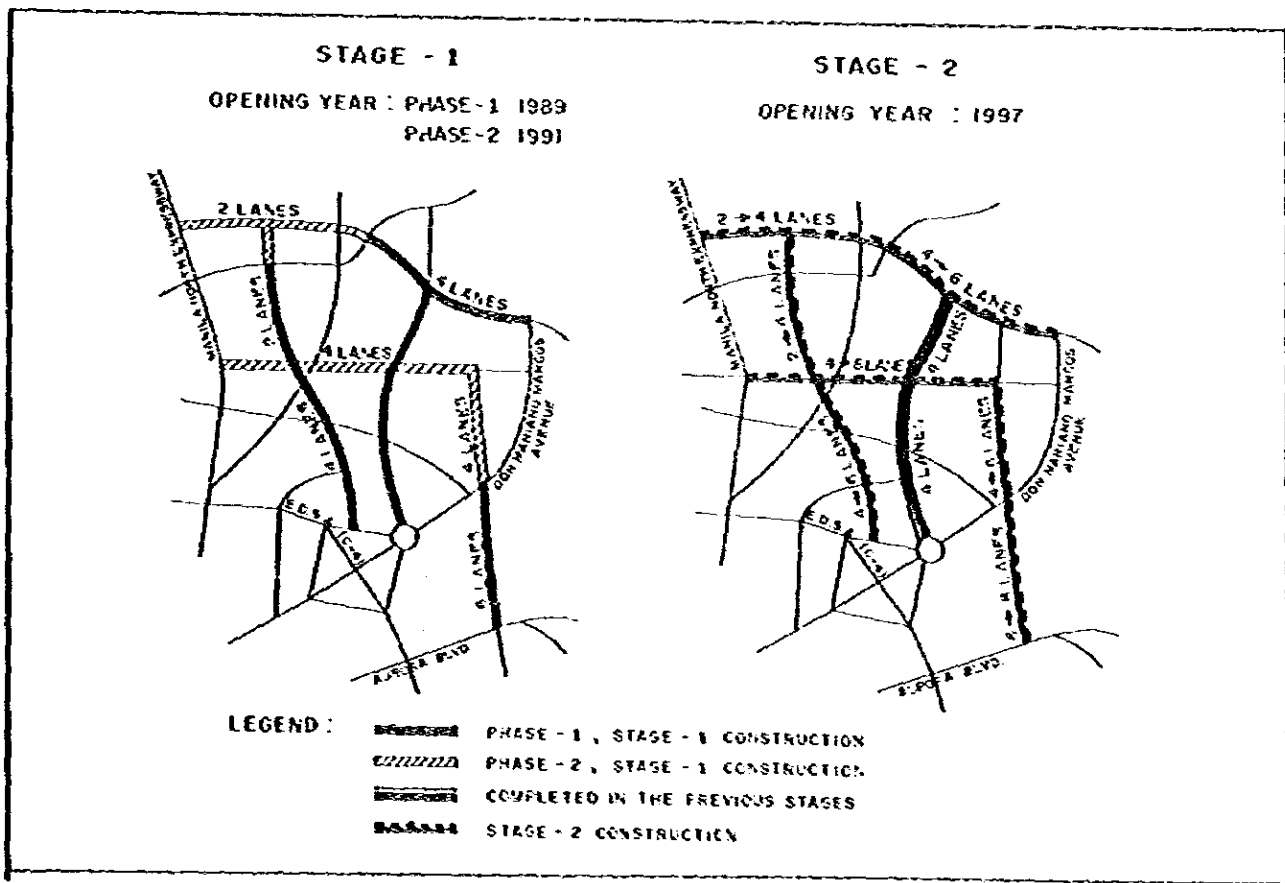
A. CONCLUSION

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.

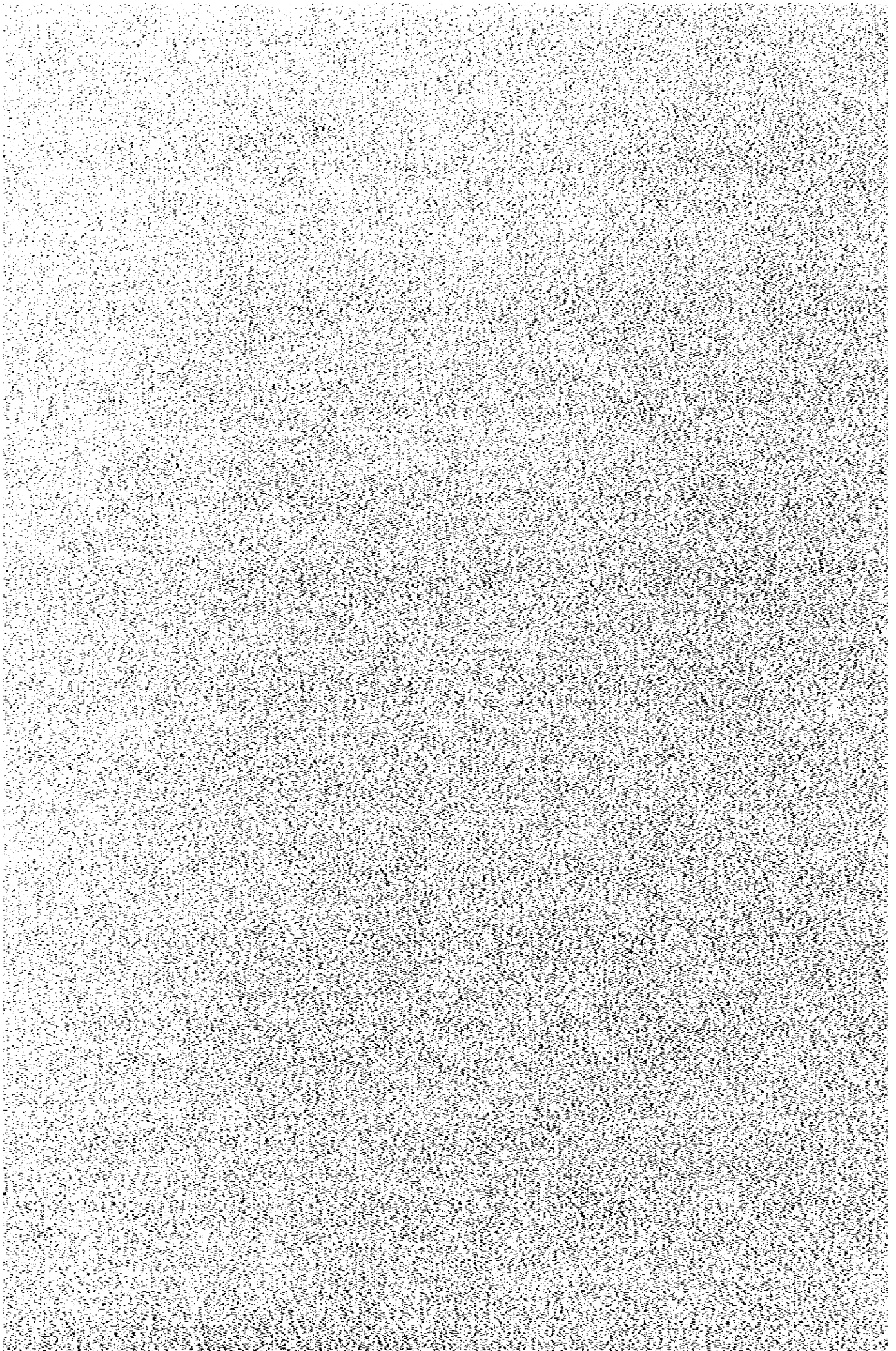
Originally, there were three (3) alternative plans considered for the project roads. The first is a conservative plan aiming at the least investment, the second is an extensive road development requiring the biggest amount of investment while the third is the intermediate plan of the first two. Due to 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



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 DIZ should be implemented as early as possible for the much needed accessibility 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 2
	PHASE 1	STAGE 1 PHASE 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 Ouirino 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

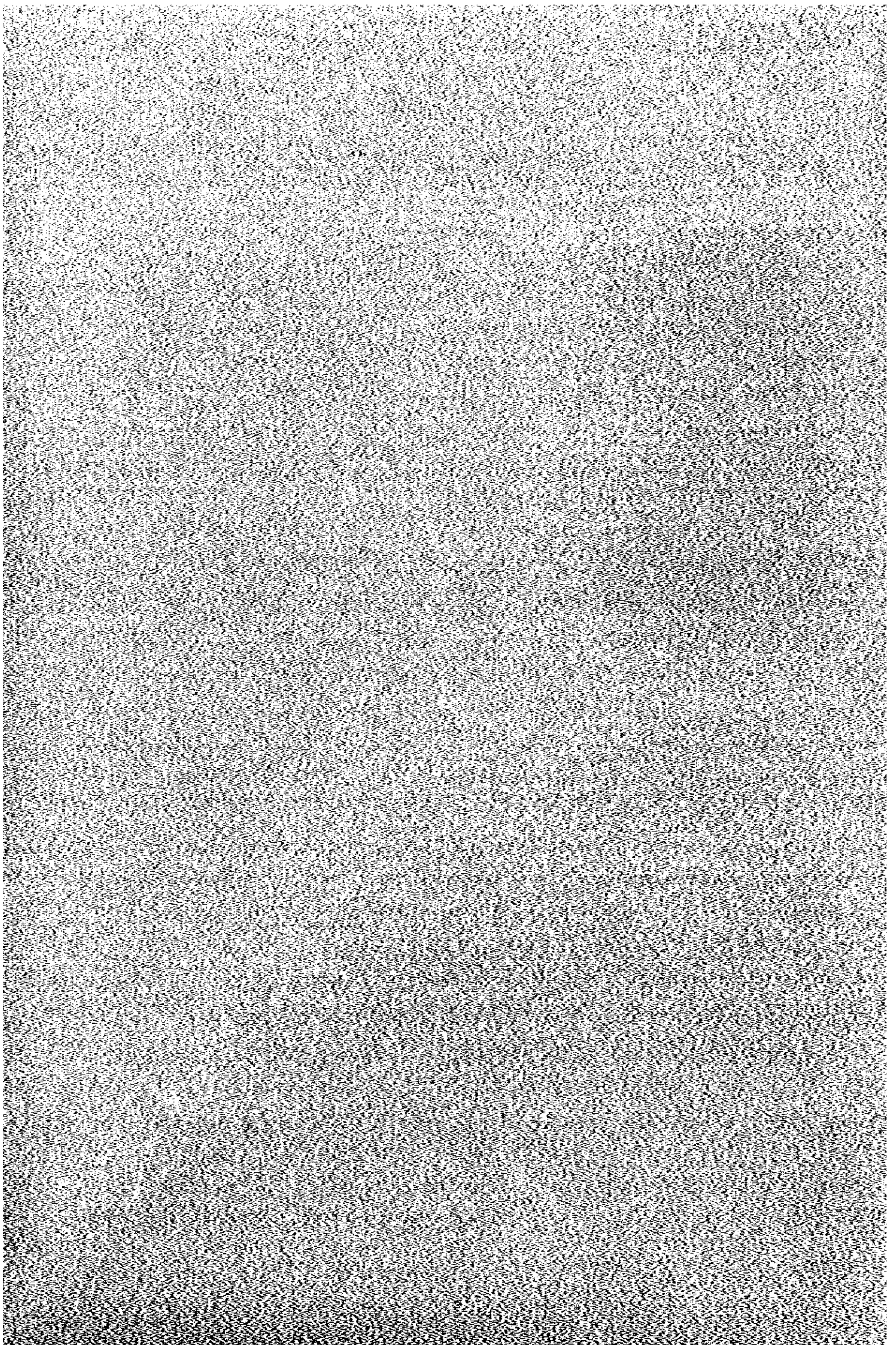
Congressional Avenue:

End of Congressional Avenue to Visayas Avenue

Luzon Avenue Extension:

Section from Republic Avenue to C-6

C. PROJECT IMPACTS



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%)
Qurino 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.

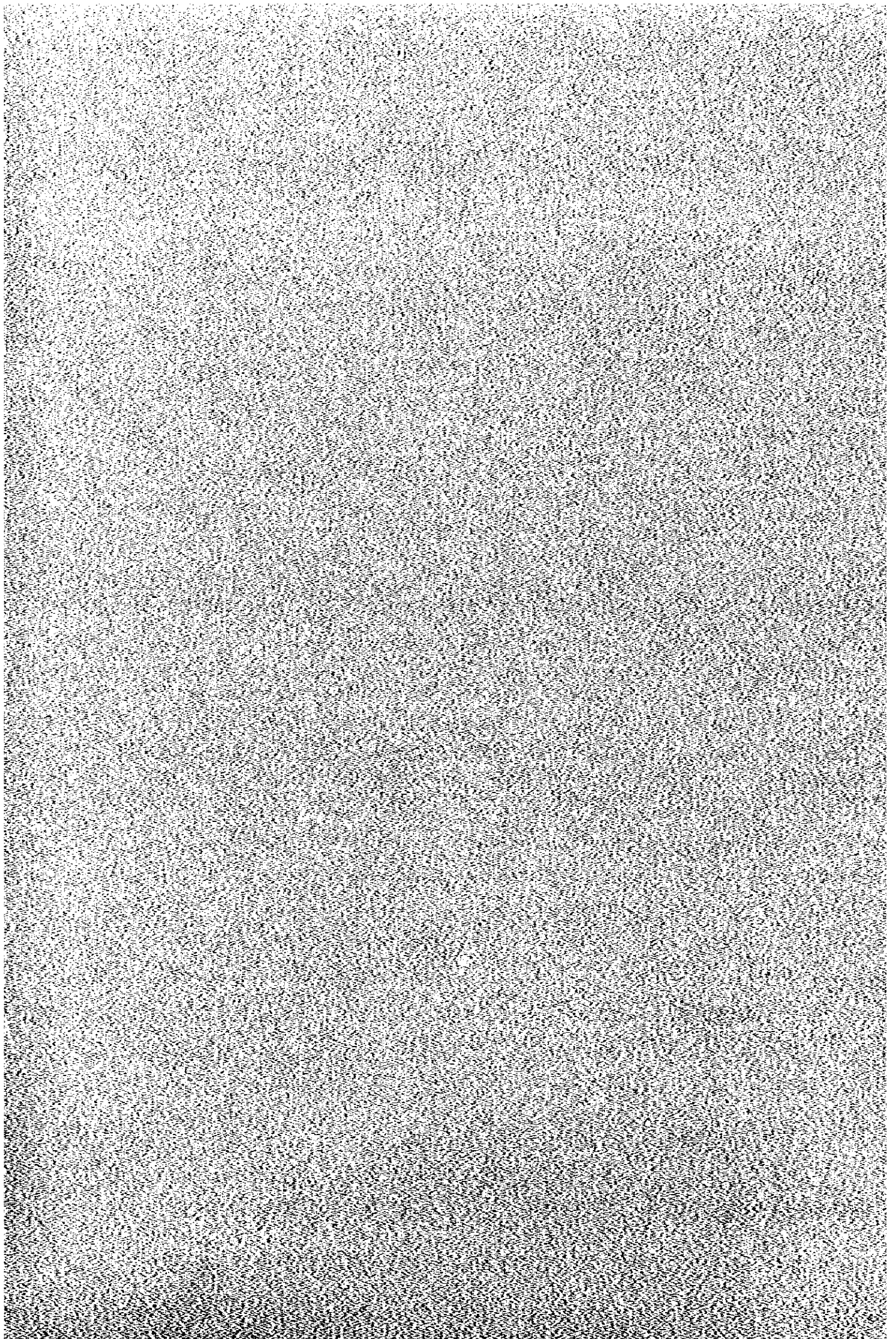
The Project Roads, when implemented, will provide direct and even access to most areas of the DIZ, thereby accelerating the urbanization of the DIZ in a sound and orderly manner.

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 P104.4 million, P146.2 million in 1991 and P198.5 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



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.

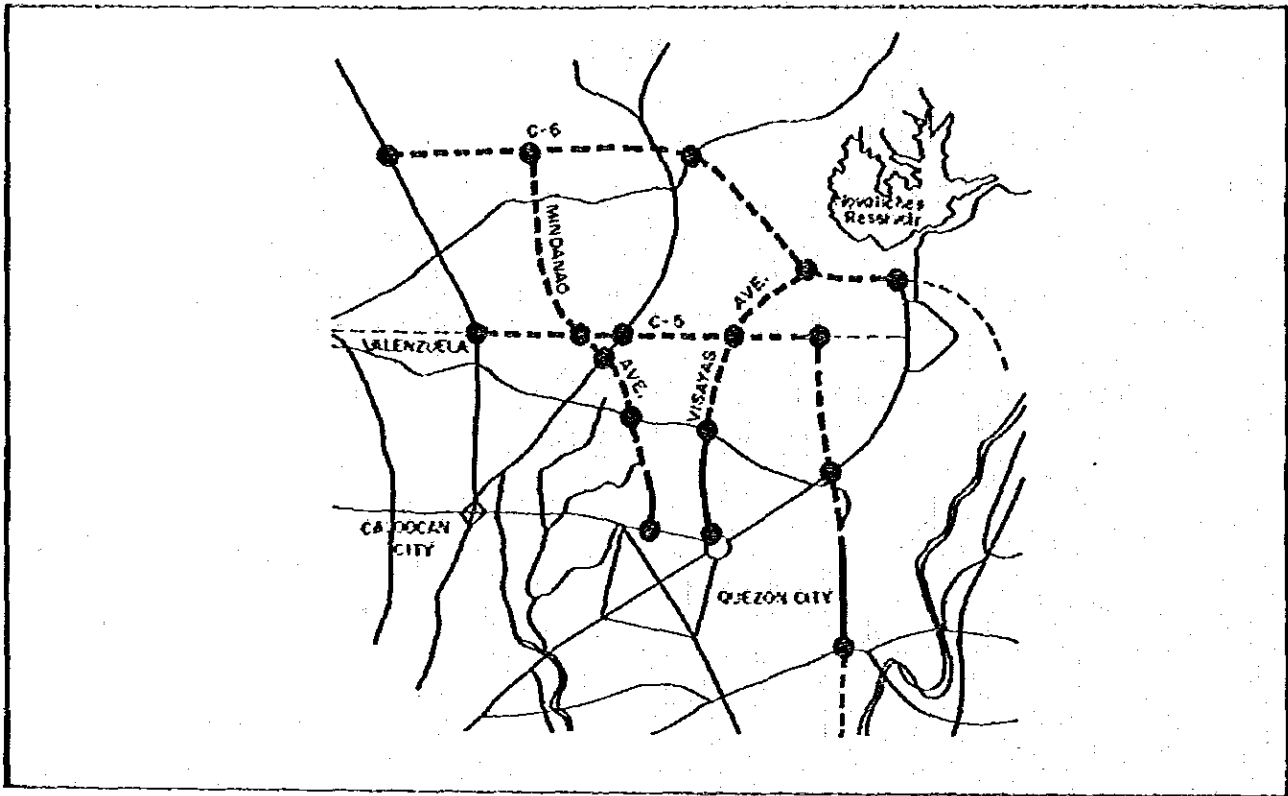
2. THE PROJECT

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



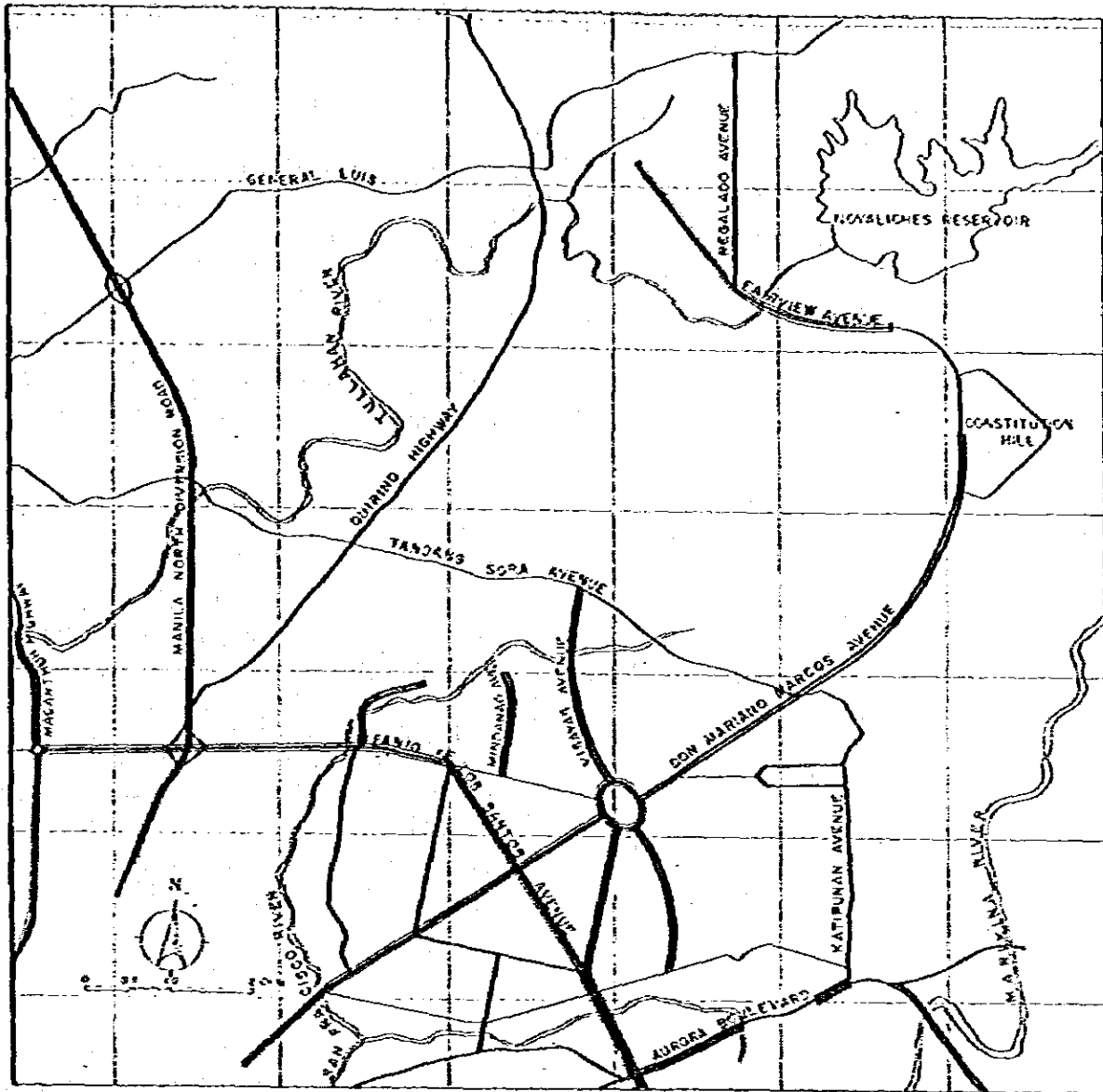
3. DEFICIENCIES OF THE PRESENT ROAD NETWORK IN THE DIZ

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 a 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 along with the national Five-Year Plan. NCR, holding an estimated one-eighth 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

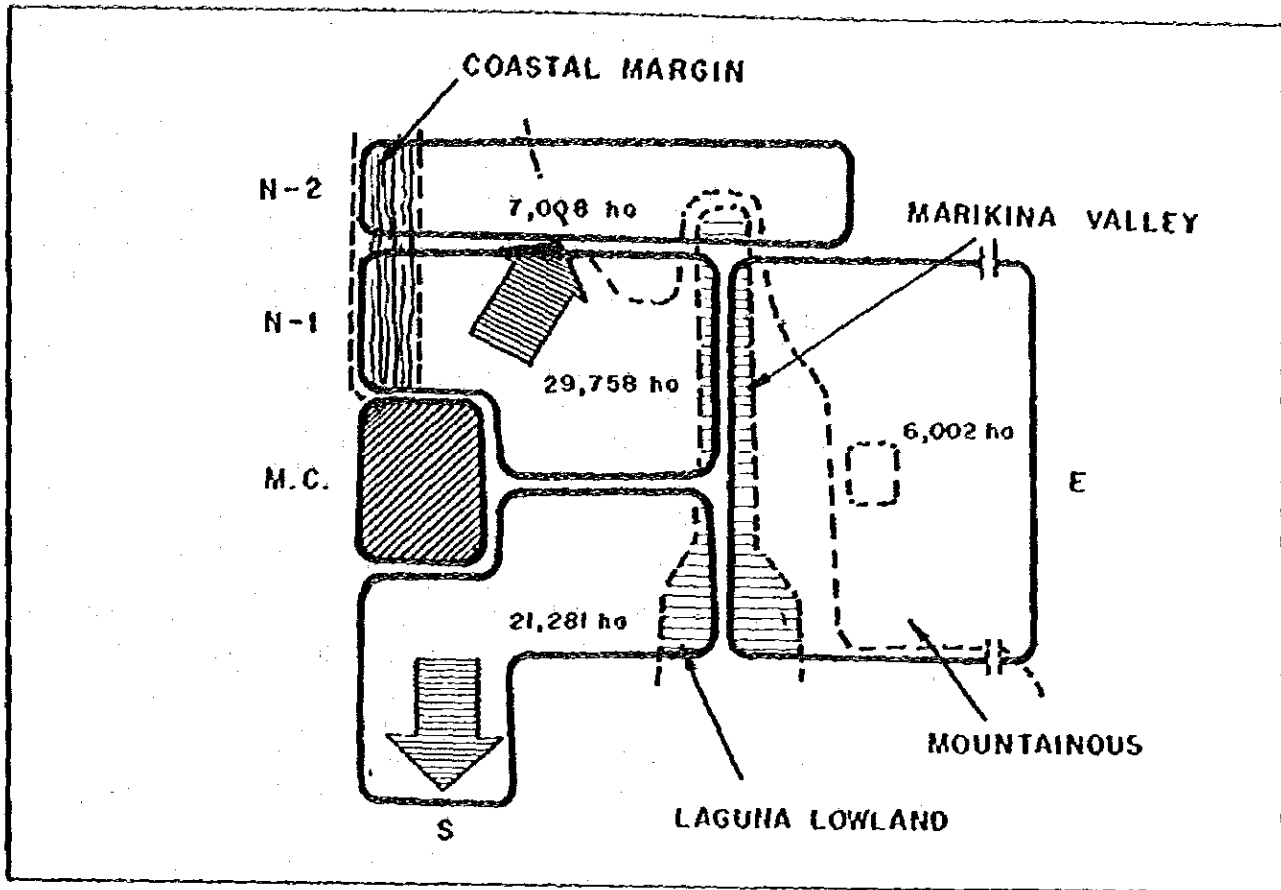
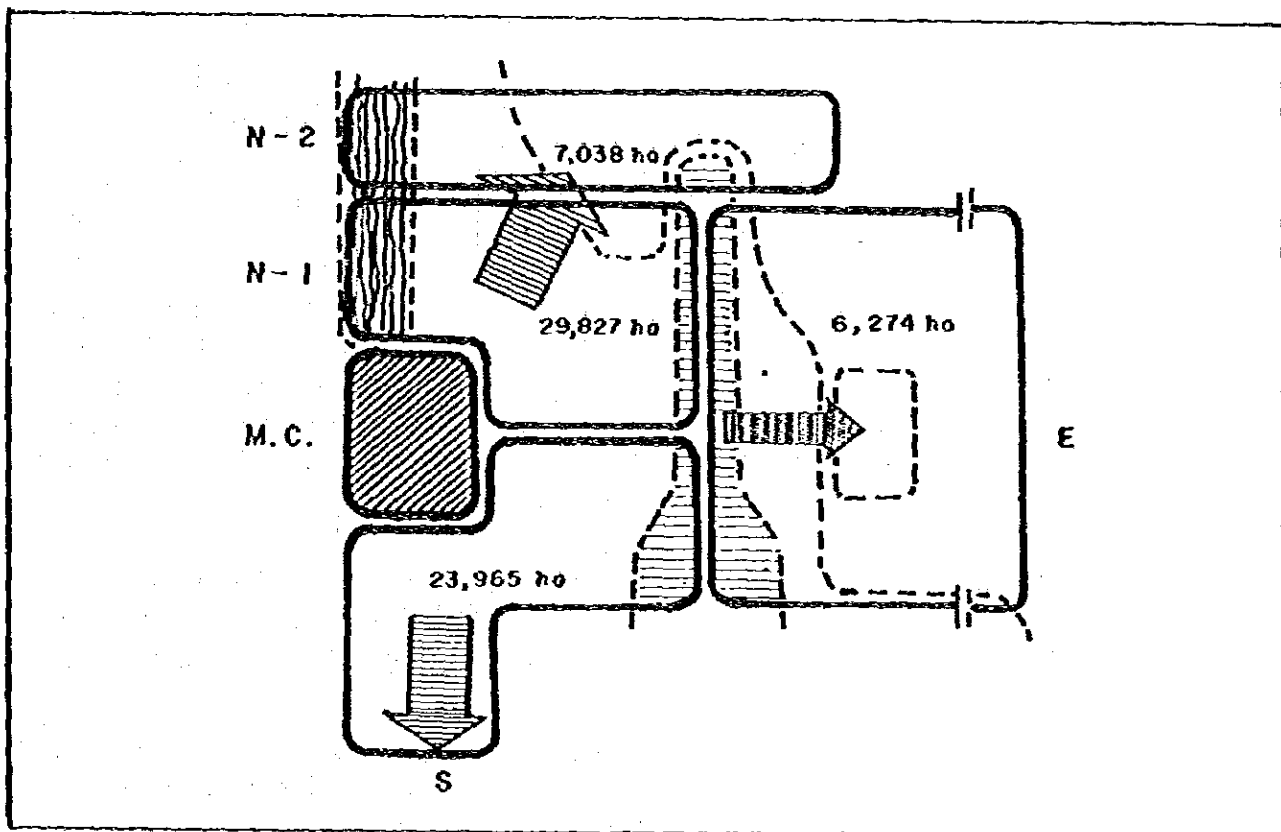


FIGURE 5. EXPANSION PATTERN OF URBAN AREA 2000



- ii) Development plan for the NCR is assumed to follow the strategy set forth by the RDFP and the CIF;
- iii) The directions of 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

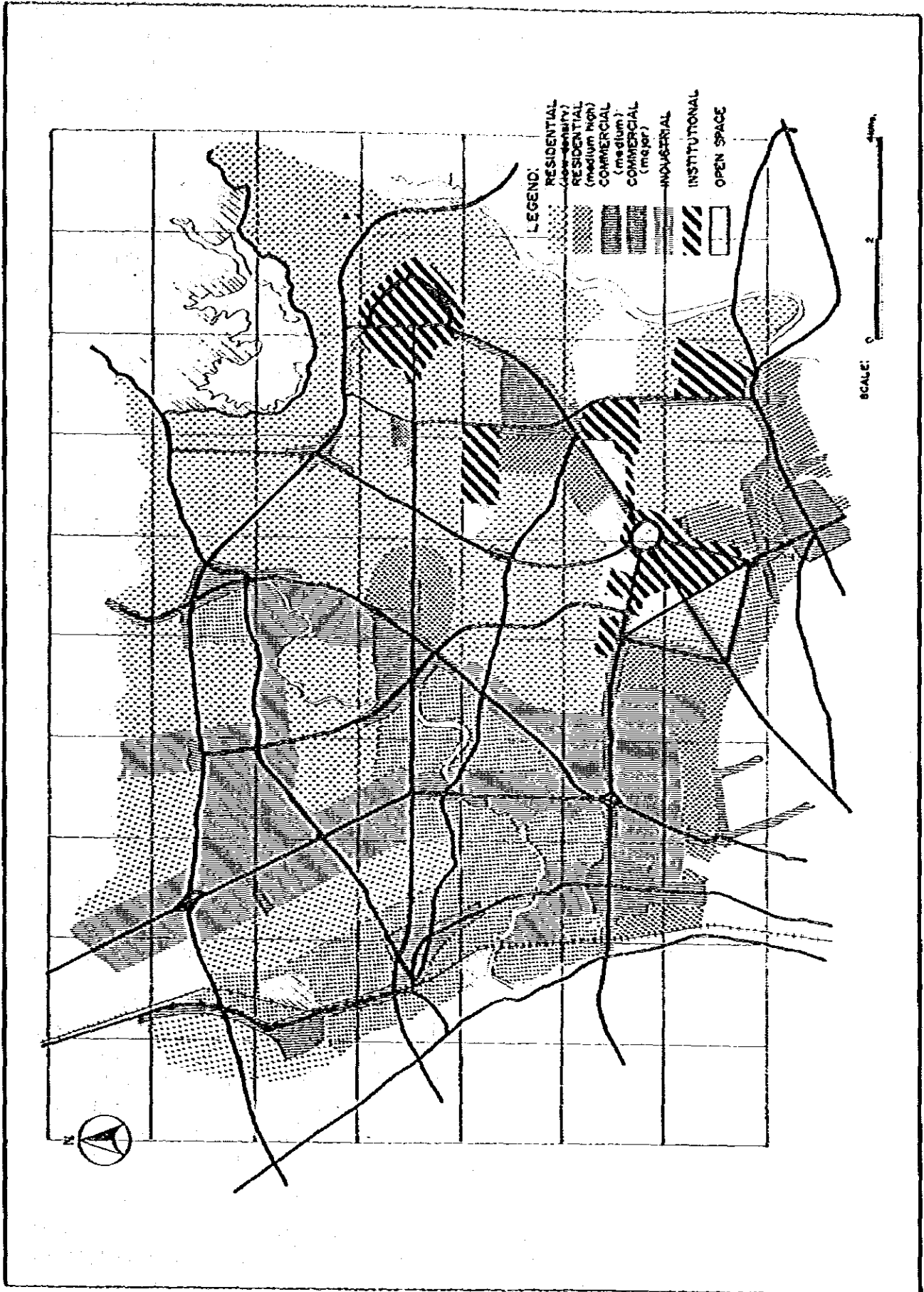
1) Present Traffic Characteristics

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 frequency 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