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DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

THE FEASIBILITY STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY

(Sta. Rita, Plaridel - San Jose Section)

FINAL REPORT

MAIN TEXT

NOVEMBER 1999

KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO.,LTD.

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PREFACE

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct a Feasibility Study on Upgrading Inter-Urban Highway System along the Pan-Philippine Highway (Sta. Rita, Plaridel – San Jose Section) and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Tsuneo Bekki of Katahira & Engineers International, and consisting of Katahira & Engineers International and Yachiyo Engineering Co., Ltd. to the Philippines, two times between November 1998 and November 1999. In addition, JICA set up an advisory committee headed by Mr. Takahiro Hisano, Director of Road Division, Kyushu Regional Construction Bureau, the Ministry of Construction between November 1998 and November 1999, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of the Philippines and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the Team.

November 1999

Kimio Fujita
President
Japan International Cooperation Agency

November 1999

Mr. Kimio Fujita
President,
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

We are pleased to submit to you the Final Report of the feasibility study on upgrading inter-urban highway system along the Pan-Philippine Highway (Sta. Rita, Plaridel – San Jose Section) in the Republic of the Philippines. The report reflects the advice and suggestions of the authorities concerned of the Government of Japan and your Agency.

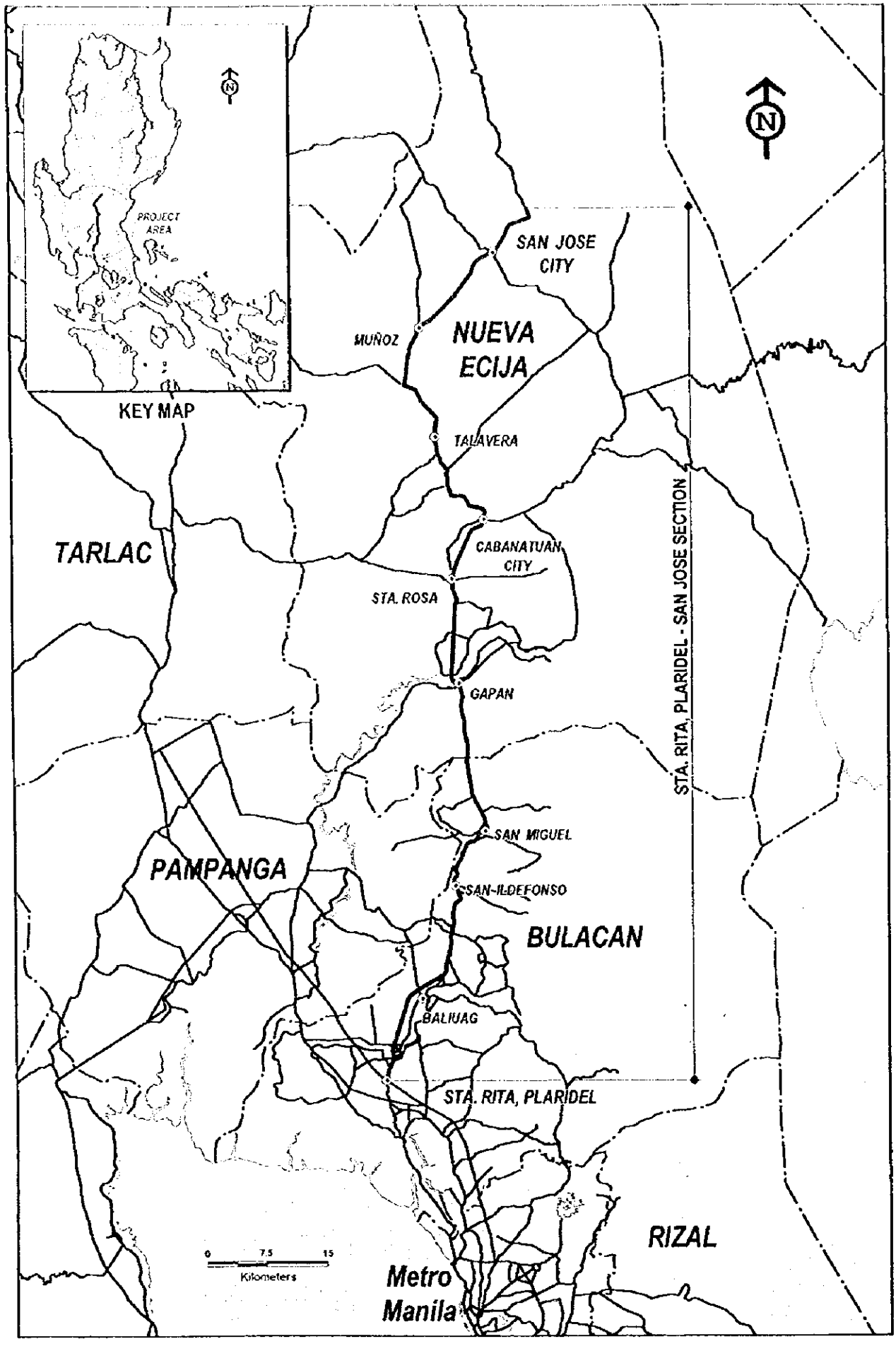
This report presents the results of the Study which had the objectives of providing the new concept of upgrading measures for the highway system and applying it to the highway design, and carrying out a feasibility study on the three bypasses that were proposed for solving the present and future traffic demands. This report is divided into six parts which include on the study area and roads, survey and analysis, development of upgrading measures, selection of the best bypass route, feasibility study and project implementation.

Considering the present and future traffic function in the study area, this project is urgent and necessary for the Philippines. We recommend that the Government of the Philippines realize this project with high priority.

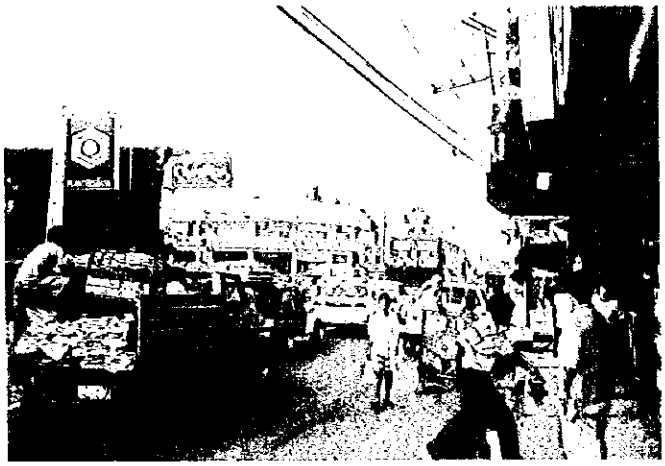
We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Construction of Japan. We also wish to express our deep gratitude to the Department of Public Works and Highways and other authorities concerned of the Government of the Philippines for the close cooperation and assistance extended to us during the course of the Study.

Very truly yours,

Tsuneo Bekki
Team Leader,
The Study Team for the Feasibility Study
on Upgrading Inter-urban Highway System
along the Pan-Philippine Highway
(Sta. Rita, Plaridel - San Jose Section)

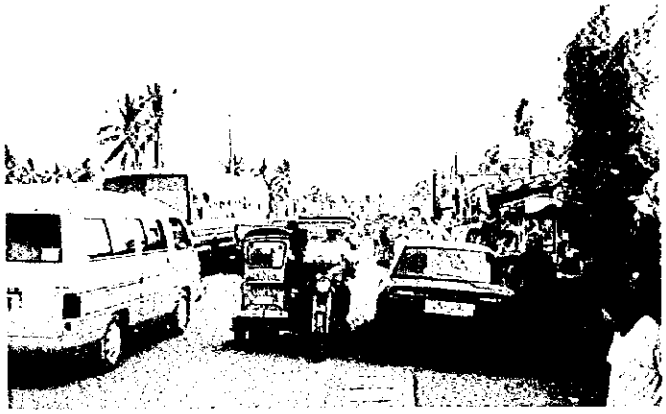


LOCATION MAP



① Traffic congestion at Plaridel intersection

② High proportion of slow vehicles in urban section of Gapan



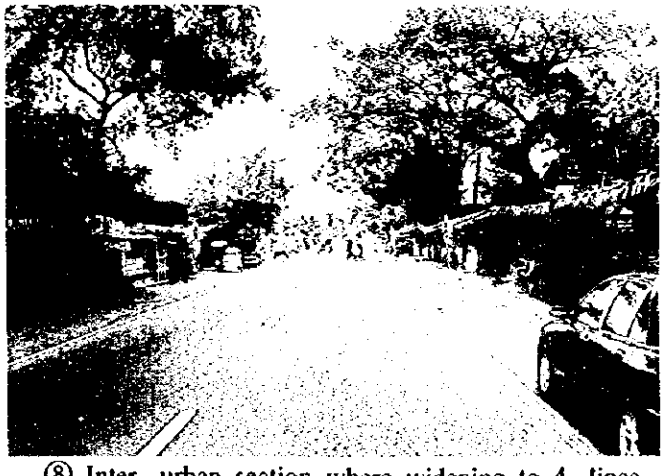
③ Traffic congestion in urban section of Sta. Rosa

④ Many tricycles crossing the Pan - Philippine Highway at a intersection in Cabanatuan City

⑤ Traffic congestion in urban section of Cabanatuan City

⑥ Traffic congestion at a major intersection in San Jose City (4 - lane)

⑦ Many vehicles parking at roadside in urban area of Talavera



⑧ Inter - urban section where widening to 4 - lines is difficult

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ABBREVIATIONS

AADT	:	Annual Average Daily Traffic
AASHTO	:	American Association of State Highway and Transportation Officials
AC	:	Asphalt Concrete
ADT	:	Average Daily Traffic
B/C	:	Benefit / Cost Ratio
BOC	:	Bureau of Construction, DPWH
BCBWSP	:	Bulacan Central Bulk Water Supply Project
BOE	:	Bureau of Equipment, DPWH
BOM	:	Bureau of Maintenance,DPWH
CEO	:	City Engineerng Office
DAO	:	DENR Administative Order
DEO	:	District Engineering Office
DENR	:	Department of Environment and Natural Resources
DILG	:	Department of Interior and Local Governments
DPWH	:	Department of Public Works and Highways
ECA	:	Environmental Critical Area
ECC	:	Environmental Clearance Certificate
ECP	:	Environmentally Critical Project
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Rate of Return
EIS	:	Environmental Impact Statement
EMB	:	Environmental Management Bureau
EMK	:	Equivalent Maintenance Kilometer
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
GOJ	:	Government of Japan
GOP	:	Government of the Republic of the Philippines
GRDP	:	Gross Regional Domestic Product
GVA	:	Gross Value Added
HCM	:	Highway Capacity Manual
HUDCC	:	Housing and Urban Development Coordinating Council
IEE	:	Initial Environmental Examination
JICA	:	Japan International Cooperation Agency
LGU	:	Local Government Unit
LOS	:	Level of Service

MBA	:	Maintenance By Administration
MBC	:	Maintenance By Contract
NCR	:	National Capital Region
NCSO	:	National Census and Statistic Office
NEDA	:	National Economic Development Authority
NEPC	:	National Environmental Protection Council
NHA	:	National Housing Authority
NIA	:	National Irrigation Administration
NLE	:	North Luzon Expressway
OD	:	Origin-Destination
PCC	:	Portland Cement Concrete
PCU	:	Passenger Car Unit
PHMMS	:	Philippine Highway Maintenance Management System
PGA	:	Proponent Government Agency
PMO	:	Project Management Office
PNP	:	Philippine National Police
PPFP	:	Provincial Physical Framework Plan
PPP	:	Philippine Population Projection
ROW	:	Right-of-Way
SDP	:	Social Development Program
TWG	:	Technical Working Group

PART I

GENERAL

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The systematic road network development in the Philippines began in the late 1960s. The road development thrust was initially placed on the expansion of road network in order to provide the basic access to major regions. Since the middle of 1980s, the Government of the Philippines (hereinafter referred to as "GOP") suffered premature road deterioration such as pavement and bridge deterioration as well as road damages like slope failures and landslides due to natural calamities. To cope with such situations, the GOP's emphasis for the road development, through its implementing agency, the Department of Public Works and Highway (hereinafter referred to as "DPWH") was placed on the rehabilitation and conversion of existing roads to more durable roads against natural calamity. In line with this policy, various road projects have been implemented up to the present.

Recent years' economic growth brought about the sharp increase of road traffic in and around Metro Manila and regional growth pole cities. Particularly urban sections along arterial roads encountered sharp increase of not only local traffic but also through traffic, thus the road function, particularly the traffic function of arterial roads is being seriously affected. Upgrading of traffic function of arterial roads and proper sharing of road function with roads of lower categories are becoming vital issues to be addressed in the road development policies, particularly along the Pan-Philippine Highway.

The road section from Sta. Rita, Plaridel to San Jose of the Pan-Philippine Highway (hereinafter referred to as "the Study Road") starts at about 40 km north of Metro Manila and extends for about 123.5 km. It is located in Region III and within the economic influential area of Metro Manila. Along the Study Road, small and medium size urban centers are situated at about 10 km interval and urbanization is expanding as a ribbon type development. In urban sections of the Study Road, the traffic function of the Pan-Philippine Highway as the arterial road is being seriously affected due to the high composition of slow and disorderly moving traffic such as tricycles and jeepneys.

These issues must be studied and implemented in close coordination with the urban development plan, future land use plan and local roads development plan of respective Local Government Units (hereinafter referred to as "LGU"), however, the planning and implementing capability of LGU is not sufficient yet, and DPWH has not developed a highway improvement policy and planning to cope with the above issues.

To cope with above issues, GOP through DPWH sought a technical assistance from the Government of Japan (hereinafter referred to as

"GOJ") for the conduct of the **Feasibility Study on Upgrading Inter-Urban Highway System Along the Pan-Philippine Highway (Sta. Rita, Plaridel - San Jose Section)** (hereinafter referred to as "the Study").

In response to the request of GOP, GOJ has decided to conduct the Study through the Japan International Cooperation Agency (hereinafter referred to as "JICA"), which is the official agency responsible for the implementation of the technical cooperation program of GOJ. JICA has organized and dispatched a Study Team for the Study in accordance with the Implementing Arrangement signed on July 22, 1998 between DPWH and the JICA Preparatory Study Team.

1.2 OBJECTIVES OF THE STUDY

The objectives of the Study are:

- to carry out a feasibility study on improving the traffic capacity of the Sta. Rita (Plaridel) – San Jose Section of the Pan-Philippine Highway.
- to exercise the maximum technology transfer to the Philippine counterpart persons through conduct of the Study.

1.3 STUDY ROAD AND STUDY AREA

The Study Road is the Sta. Rita (Plaridel) – San Jose section (from Junction of North Luzon Expressway at Km. 38+500 to Km. 162+000) of the Pan-Philippine Highway. The Study Area shall cover the Study Road and its influential areas.

1.4 SCOPE OF THE STUDY

The Study was conducted in two phases, covering, among others, the following items;

<u>Phase 1</u>

1) Present condition survey, data collection and analysis
2) Aerial photography and photomosaic
3) Traffic survey and analysis
4) Review of present design concept and standards
5) Roadside environmental survey
6) Establishment of socio-economic framework
7) Future traffic demand forecast
8) Formulation of basic road development plan
9) Initial environmental examination
10) Development of alternatives
11) Evaluation and selection of the best alternative route

Phase 2

1) Engineering survey
2) Preliminary design
3) Construction plan
4) Road maintenance program
5) Cost estimate
6) Environmental impact assessment
7) Resettlement plan of affected people
8) Economic and financial evaluation
9) Project implementation program
10) Overall project evaluation and recommendations

Workshops were held jointly by DPWH and the JICA Study Team inviting a Technical Working Group members and concerned LGU officials at the time of report presentation and whenever needs arised.

1.5 EXECUTION OF THE STUDY

1.5.1 Study Schedule

Figure 1.5-1 presents the work schedule and flow of the Study, which commenced in the early November 1998 and completed at the end of October 1999 for a total duration of about 12 months.

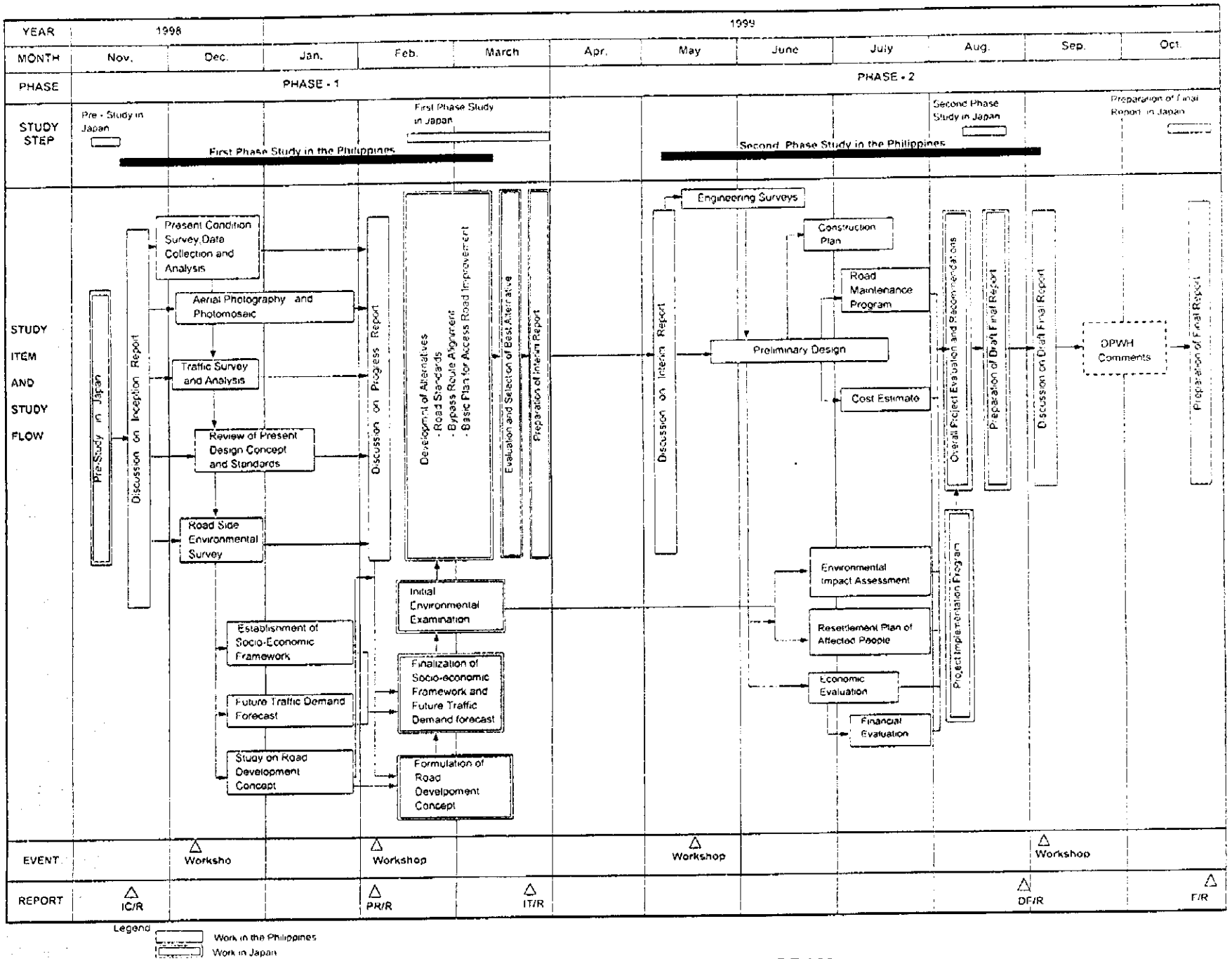


FIGURE 1.5-1 STUDY FLOW DIAGRAM

1.5.2 Organization for Executing the Study

JICA organized a Study Team to carry out the Study and an Advisory Committee to review the findings of the Study, while DPWH organized a Counterpart Team to collaborate with the JICA Study Team in carrying out the Study, and a Steering Committee and a Technical Working Committee to ensure smooth conduct of the Study and to review and oversee the progress of the Study. The organization chart is shown in Figure 1.6-1.

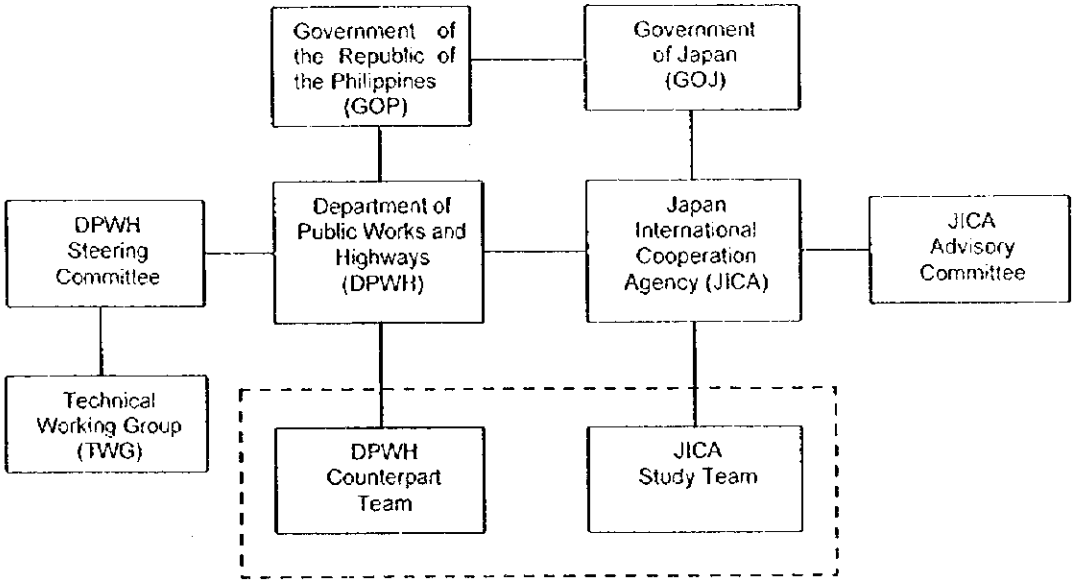


FIGURE 1.6-1 ORGANIZATION FOR EXECUTING THE STUDY

The members participating in the Study are as follows:

DPWH Steering Committee

Chairman	:	Undersecretary **TEODORO T. ENCARNACION**
Co-Chairman	:	Asst. Secretary **JESUS P. CAMMAYO**
Member	:	Director **LINDA TEMPLO**, Planning Service
Member	:	Director **BIENVENIDO C. LEUTERIO**, Bu. of Design
Member	:	Director **LOPE S. ADRIANO**, PMO-PJHL
Member	:	Proj. Manager **GERONIMO S. ALONZO**, OIC, PMO-FS
Member	:	Director **EDILLO C. MONTEMAYOR**, DPWH, Reg. III
Member	:	Director **FEDERICO C. GASPAN**, DPWH, Reg. III
Member	:	Mr. **SEIICHI ONODERA**, JICA Highway Adviser

Technical Working Group

Chairperson	:	Ms. **LINDA M. TEMPLO**, Director, Planning Service
Vice-Chairperson	:	Mr. **GERONIMO S. ALONZO**, Project Manager II, PMO-FS (Project Team Leader)
Members (Regular)		
DPWH	:	Mr. **FAUSTINO N. STA.MARIA,JR.** Project Manager I, PMO-FS (Project Coordinator)
	:	Ms. **REBECCA T. GARSUTA**, Chief, DPD, Planning Service
	:	Ms. **MERLINDA G. ALCARAZ**, Engineer IV, DPD, Planning Service
	:	Mr. **SEIICHI ONODERA**, JICA Highway Advisor
NEDA	:	Ms. **LYNETTE Y. BAUTISTA**, Asst. Director, NEDA Reg. III
Secretariat		
Central Office	:	Ms. **MARITESS V. REYES**, Engr. III, IPRSD, Planning Service
PMO-FS	:	Ms. **BELLA H. RESURRECCION**, Economist IV, PMO-FS

DPWH Counterpart Team

Proj. Coordinator / Sr. Traffic Engineer	:	Mr. **FAUSTINO STA. MARIA,JR.**
Transport Planner	:	Mr. **CARMELINO TIZON**
Regional Planner	:	Ms. **VICTORIA CORPUZ**
Road Design Engineer	:	Mr. **EPHRAIM CAPUCAO**
Natural Condition Engineer	:	Ms. **MARIETTA VELASCO**
Bridge Design Engineer	:	Mr. **MARINO AMORES**
Construction Engineer	:	Mr. **EDMUNDO MANGAOIL**
Cost Engineer	:	Mr. **ARTURO FLORES**
Traffic Engineer	:	Mr. **CESARIO VICENTE**
Traffic Engineer	:	Mr. **MAXIMO MONTANA**
Environmental and Social Impact Analyst	:	Mr. **ALVIN MADRID**
General Economist	:	Mr. **ROMEO LESCANO**
Financial Analyst	:	Ms. **BELLA RESURRECCION**

JICA Advisory Committee

Chairman	:	Mr. **TAKAHIRO HISANO** Kyushu Regional Construction Bureau, Ministry of Construction
Member	:	Mr. **FUMITOSHI TSUNODA** Chugoku Regional Construction Bureau, Ministry of Construction

JICA Study Team

Team Leader / Highway Planner	:	Mr. **TSUNEO BEKKI**
Regional Planner / Transport Planner	:	Mr. **TOSHIHIRO HOTTA**
Traffic Engineer	:	Mr. **KIMINARI TACHIYAMA**
Highway Engineer	:	Mr. **YUICHIRO IKEMOTO**
Highway Engineer	:	Dr. **SHINGO GOSE**
Structural Engineer	:	Dr. **MALEK NOUREDDINE**
Construction Engineer / Cost Estimator	:	Mr. **KAZUFUMI HONMA**
Natural Condition Survey Engineer	:	Mr. **KENTARO USUDA**
Environmental Specialist	:	Ms. **ANNABELLE HERRERA**
Transport Economist	:	Mr. **TETSUO WAKUI**

1.6 REPORTS

The following reports were prepared during the course of the Study:

- Inception Report (November 1998)
- Progress Report (February 1999)
- Interim Report (March 1999)
- Draft Final Report (August 1999)

The Final Report is organized with the following:

- Executive Summary
- Main Text
- Appendix
- Drawings

CHAPTER 2

PROFILE OF THE STUDY AREA AND ROAD

CHAPTER 2

PROFILE OF THE STUDY AREA AND ROAD

2.1 PHYSICAL PROFILE

2.1.1 Topography

The topography of Bulacan Province ranges from flat to rugged terrain as shown in Figure 2.1-1. The western portion of Bulacan is classified as lowland with approximately 50% of the province's land area. In about 40% of the area, or 106,795 has., the ground slope is less than eight percent (i.e. flat to gently sloping terrain). The general elevation in the area falls below 100 meters above mean sea level (msl). On the other hand, the eastern part of the province includes areas that are hilly and mountainous. The province extends into the Sierra Madre Mountain Range, which runs from Cagayan Province in the north and down through the southeastern part of Luzon. Here, land areas with rugged mountains are present, with the general elevations of at least 300 meters above mean sea level. These areas represent some 25% of the province's total land area.

The terrain of Nueva Ecija Province comprises of low lying alluvial plains and rolling uplands. The alluvial plains are found in the western, central, and southwestern parts adjacent to the provinces of Tarlac, Pampanga, and Bulacan. The rolling uplands are found in the northern, eastern and southeastern parts of the province. The province is bounded in part by the rugged and complex topography of the Carraballo Mountains in the north and the Sierra Madre Mountains in the east. Small but remarkable are the non-active volcanic cones which can be found near the boundaries of Pangasinan and Nueva Vizcaya. The Sierra Madre Mountains along the boundary between Nueva Ecija, Quezon and Aurora provinces, consists of scattered peaks with the highest elevation of approximately about 1,724 meters above mean sea level. The lowest land area in the province is located in the southwestern part, bordering the province of Pampanga. This area is part of the vast Candaba Swamp and has an elevation of approximately 12 meters above mean sea level.

The topography along the Study Road is generally flat. The Study Road crosses four major rivers, namely the Angat, the Peñaranda, the Pampanga and the Talavera Rivers, and numerous small rivers and irrigation channels.

2.1.2 Geology

In Bulacan, the geologic structure is made mostly of igneous and sedimentary rock materials. The eastern plank of the province is generally volcanic in nature as the various landforms were formed through organic and tectonic processes during the Miocene period. The major rock formations in Bulacan include the Undifferentiated Volcanic, Lumot Volcanic,

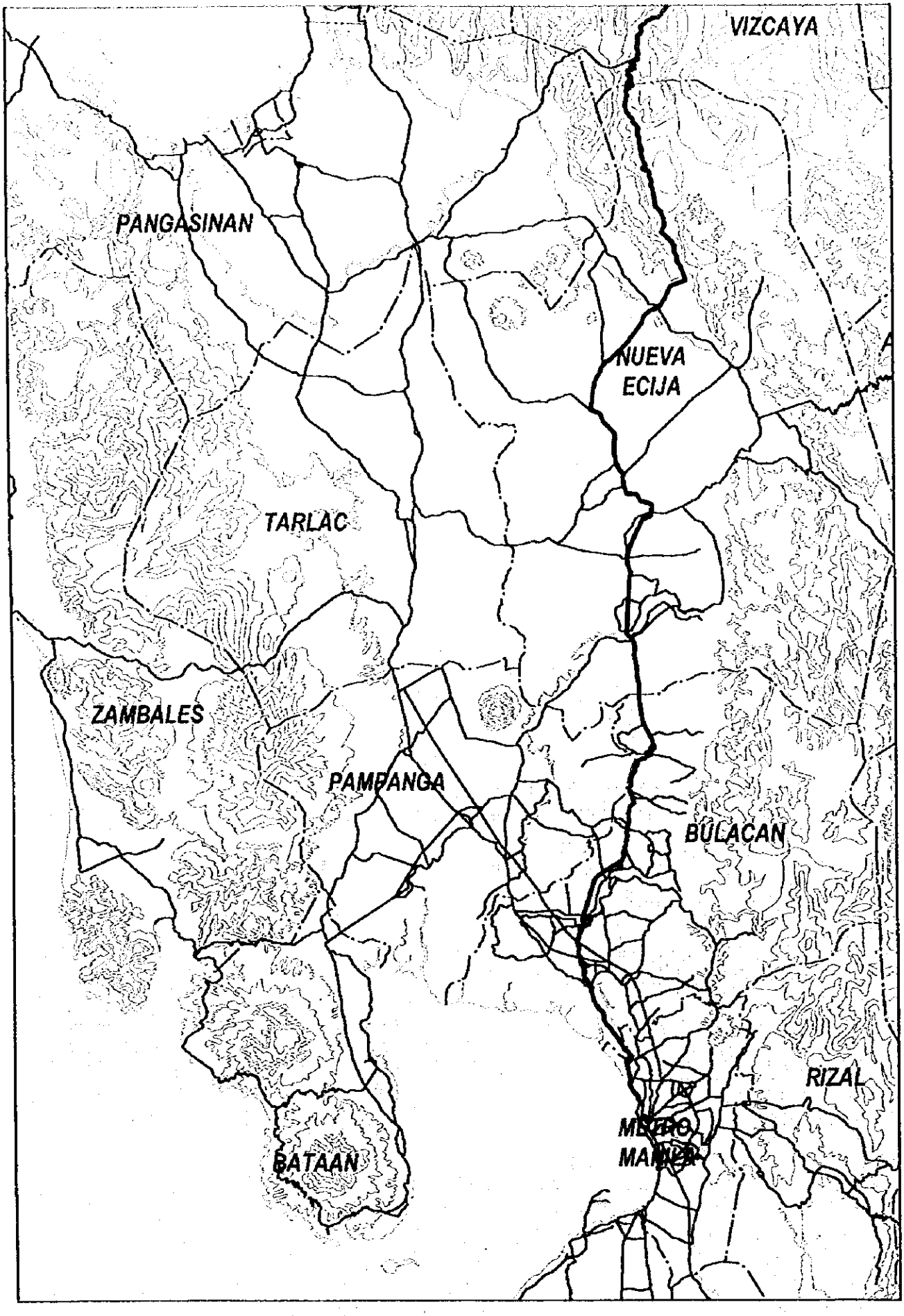


FIGURE 2.1 - 1 TOPOGRAPHY OF REGION III

Quartz Diorite, Andesite and Basaltic Series, Pyroclastics, and Volcanic Agglomerates. The two limestone formations in the northern and southern parts of the province stemmed from the uplift of what was once a huge shoreline limestone. The other major type of sedimentary rock formations and the only formation encountered along the Study Road, are the *Recent Alluvial Formation* which resulted from the deposition of weathered rock materials by rivers, creeks, and streams on low level areas. These rock formations are commonly found in the western section of Bulacan that include the municipalities of Obando, Bulacan, Guiguinto, Hagonoy, Paombong, Malolos, Calumpit, Plaridel Pulilan, Bocaue, Baliuag, and San Miguel.

The rock formations in the province of Nueva Ecija are represented by time rock units ranging in ages from Pre-Cretaceous (Basement Complex which is the oldest) to Quaternary. The Basement Complex and the Cretaceous-Paleogene Rock Formations constitute the dominant rocks that underlie the mountainous areas of the province. The rocks are intruded by diorite, probably of more than one kind, syenite and other intrusive phases or offshoots.

A broad expanse of Recent Alluvial deposits which include the alluvial fan deposits, river deposits, and the flood plain deposits cover approximately half of Nueva Ecija province. These alluvial deposits are the dominant material found along the Study Road.

2.1.3 Meteorology

Climate

The meteorological stations closest to the province of Bulacan and Nueva Ecija are located in the Science Park, Quezon City and in Cabanatuan City, Nueva Ecija, respectively. The climatological characteristics are shown in Tables 2.1-1 & 2.1-2. The climate in the said provinces belongs to Type I of the Modified Corona's Classification. This type of climate is characterized by two pronounced wet and dry seasons. A well defined rainy season occurs in the months of June to September, while the dry season is experienced during the months of the November to April.

TABLE 2.1-1 CLIMATOLOGICAL CHARACTERISTICS : BULACAN

For the Province of Bulacan
STATION : Science Garden, Agham Road, Quezon City

Month	Rainfall mm	No. of Rainy Days	TEMPERATURE (°C)			Humidity	WIND	
			Maximum	Minimum	Mean	Relative Humidity %	Direction	Speed MPS
JANUARY	19.0	4	30.2	20.1	25.1	75	NE	2
FEBRUARY	7.2	2	31.4	20.1	25.8	70	NE	2
MARCH	17.2	3	33.2	21.3	27.2	67	SE	2
APRIL	31.7	4	34.8	22.6	28.8	35	SE	2
MAY	143.6	12	34.5	23.9	29.2	72	SE	2
JUNE	350.7	19	32.4	23.9	28.1	80	SW	2
JULY	467.7	22	31.3	23.5	27.4	84	SW	2
AUGUST	504.2	24	30.8	23.5	27.1	84	SW	2
SEPTEMBER	386.9	21	31.1	23.3	27.2	84	SW	2
OCTOBER	272.6	19	31.1	22.8	26.9	83	NE	2
NOVEMBER	149.7	13	30.8	21.9	26.4	80	NE	2
DECEMBER	55.7	8	30.1	20.8	25.5	79	NE	2
ANNUAL	2406.2	151	31.8	22.3	27.1	77	NE	2

SOURCE: PAG-ASA, 1999, Climatological Normals, 1999

TABLE 2.1-2 CLIMATOLOGICAL CHARACTERISTICS : NUEVA ECIJA

STATION : 330 CABANATUAN CITY, NUEVA ECIJA
LATITUDE : 15°29'N
LONGITUDE : 120°58'E
ELEVATION : 32.0 m
PERIOD : 1961-1995

Month	Rainfall mm	No. of Rainy Days	TEMPERATURE IN DEGREES °C									WIND				
			Max.	Min.	Mean	Dry Bulb	Wet Bulb	Dew Point	VP MBS	RH%	MSLP MBS	DIR	Speed MPS	CLD OKT	DAYS TSTM	WITH LTNG
JAN.	8.1	2	31.3	20.1	25.7	25.2	21.6	20.1	23.3	73	1013.2	NE	2	4	0	0
FEB.	3.4	1	32.2	20.3	26.3	25.7	21.8	20.2	23.4	71	1013.1	NE	2	3	0	0
MAR.	13.3	2	33.4	21.3	27.4	27.0	22.8	21.1	24.9	70	1012.4	SE	2	3	1	1
APR.	21.5	3	35.1	22.8	29.0	28.6	24.0	22.3	26.7	68	1010.8	SE	2	3	3	5
MAY	165.1	11	35.3	23.8	29.5	28.9	25.0	23.6	29.0	73	1008.9	SE	2	5	12	13
JUNE	286.6	17	33.5	23.7	28.6	27.9	25.3	24.4	30.4	81	1008.3	S	2	6	13	13
JULY	358.4	21	32.3	23.5	27.9	27.2	25.1	24.4	30.4	84	1007.9	S	2	6	14	13
AUG.	378.9	23	31.6	23.4	27.5	26.8	25.0	24.4	30.4	86	1007.6	S	2	7	12	8
SEPT.	315.9	20	32.0	23.3	27.7	27.0	25.1	24.4	30.5	86	1008.4	S	1	6	13	12
OCT.	193.1	13	32.3	22.8	27.6	27.0	24.6	23.7	29.3	82	1009.5	NE	2	5	5	9
NOV.	112.6	8	32.1	21.9	27.0	26.5	23.6	22.5	27.1	78	1010.9	NE	2	5	1	2
DEC.	36.9	4	31.5	20.9	26.2	25.7	22.4	21.1	24.8	75	1012.4	NE	3	4	0	0
ANN.	1893.1	125	32.7	22.3	27.5	27.0	23.9	22.7	27.5	77	1010.3	NE	2	5	74	76

SOURCE: PAG-ASA, 1999, Climatological Normals, 1999

TABLE 2.1-1 CLIMATOLOGICAL CHARACTERISTICS : BULACAN

For the Province of Bulacan
STATION : Science Garden, Agham Road, Quezon City

Month	Rainfall mm	No. of Rainy Days	TEMPERATURE (°C)			Humidity	WIND	
			Maximum	Minimum	Mean	Relative Humidity %	Direction	Speed MPS
JANUARY	19.0	4	30.2	20.1	25.1	75	NE	2
FEBRUARY	7.2	2	31.4	20.1	25.8	70	NE	2
MARCH	17.2	3	33.2	21.3	27.2	67	SE	2
APRIL	31.7	4	34.8	22.8	28.8	65	SE	2
MAY	143.6	12	34.5	23.9	29.2	72	SE	2
JUNE	350.7	19	32.4	23.9	28.1	80	SW	2
JULY	467.7	22	31.3	23.5	27.4	84	SW	2
AUGUST	504.2	24	30.8	23.5	27.1	84	SW	2
SEPTEMBER	386.9	21	31.1	23.3	27.2	84	SW	2
OCTOBER	272.6	19	31.1	22.8	26.9	83	NE	2
NOVEMBER	149.7	13	30.8	21.9	26.4	80	NE	2
DECEMBER	55.7	8	30.1	20.8	25.5	79	NE	2
ANNUAL	2406.2	151	31.8	22.3	27.1	77	NE	2

SOURCE: PAG-ASA, 1999, Climatological Norma's, 1999

TABLE 2.1-2 CLIMATOLOGICAL CHARACTERISTICS : NUEVA ECIJA

STATION : 330 CABANATUAN CITY, NUEVA ECIJA
LATITUDE : 15°29'N
LONGITUDE : 120°58 E
ELEVATION : 32.0 m
PERIOD : 1961-1995

Month	Rainfall mm	No. of Rainy Days	TEMPERATURE IN DEGREES °C									WIND				
			Max.	Min.	Mean	Dry Bulb	Wet Bulb	Dew Point	VP MBS.	RH%	MSLP MBS.	DIR.	Speed MPS	CLD OKT	DAYS TSTM	WITH LTNG
JAN.	8.1	2	31.3	20.1	25.7	25.2	21.6	20.1	23.3	73	1013.2	NE	2	4	0	0
FEB.	3.4	1	32.2	20.3	26.3	25.7	21.8	20.2	23.4	71	1013.1	NE	2	3	0	0
MAR.	13.3	2	33.4	21.3	27.4	27.0	22.6	21.1	24.9	70	1012.4	SE	2	3	1	1
APR.	21.5	3	35.1	22.8	29.0	28.6	24.0	22.3	26.7	68	1010.8	SE	2	3	3	5
MAY	165.1	11	35.3	23.8	29.5	28.9	25.0	23.6	29.0	73	1008.9	SE	2	5	12	13
JUNE	286.6	17	33.5	23.7	28.6	27.9	25.3	24.4	30.4	81	1008.3	S	2	6	13	13
JULY	358.4	21	32.3	23.5	27.9	27.2	25.1	24.4	30.4	84	1007.9	S	2	6	14	13
AUG.	378.9	23	31.6	23.4	27.5	26.8	25.0	24.4	30.4	86	1007.6	S	2	7	12	8
SEPT.	315.9	20	32.0	23.3	27.7	27.0	25.1	24.4	30.5	86	1008.4	S	1	6	13	12
OCT.	193.1	13	32.3	22.8	27.6	27.0	24.6	23.7	29.3	82	1009.5	NE	2	5	5	9
NOV.	112.6	8	32.1	21.9	27.0	26.5	23.6	22.5	27.1	78	1010.9	NE	2	5	1	2
DEC.	36.9	4	31.5	20.9	26.2	25.7	22.4	21.1	24.8	75	1012.4	NE	3	4	0	0
ANN.	1893.1	125	32.7	22.3	27.5	27.0	23.9	22.7	27.5	77	1010.3	NE	2	5	74	76

SOURCE PAG-ASA, 1999, Climatological Normals, 1999

Air Streams

The principal air streams that significantly affect the Study Area are the Northeast Monsoon, Southwest Monsoon, and the North Pacific Trades. The Northeast Monsoon predominates from October to May, while the Southwest Monsoon prevails during June to September. The North Pacific Trades is the southern portion of the North Pacific anticlyclone. Having passed over a vast expanse of the North Pacific Ocean, this air stream is classified as a maritime tropical air mass. This air stream which is extremely warm, is generally dominant over the entire Philippines in April and early May. It commonly arrives in the country from an easterly direction but may come from any direction from northeast to southeast.

Rainfall

The highest average monthly rainfall in both Bulacan and Nueva Ecija occurs during the month of August, with average of 504.2 mm and 378.9 mm, respectively. The lowest monthly average rainfall in these two provinces is during the month of February, with an average of 7.2 mm and 3.4 mm, respectively.

Temperature

The mean monthly temperature in the province of Bulacan is 27.1°C, and in Nueva Ecija 27.5°C. In both provinces, the warmest months are April to June with mean values ranging from 28.1°C to 29.5°C. The minimum and maximum monthly temperatures in Bulacan are 22.3 and 31.8°C, respectively, and in Nueva Ecija 22.3 and 32.7°C, respectively. In both provinces, the minimum monthly temperature occurs in January and February, while the maximum monthly temperature is experienced in April.

Relative Humidity

The relative humidity in the Study Area is highest in the months of July to September. The months of December to February are relatively humid compared to those in March to April. This is due to the low temperatures brought about by the tail of the cold front during the northeast monsoon season. The transition months have intermediate values because of the average rainfall during these months.

Wind Direction and Speed

In the Study Area, the winds are mainly westerly or easterly. The observed most frequent surface wind directions are: 17% for westerly; 15% for easterly; 12% for northeasterly; 11% for northerly, southeasterly and southerly; and 9% for southwesterly.

2.1.4 Natural Calamities

Typhoon and Flood

The Philippines is often visited by typhoons with an average of 22 surges annually during the past 40 years (1946-1985). The month of November has the most number of typhoons observed with an average of nine (9) surges.

The Region has a total of 4,231 square kilometers of flood prone areas. 2,200 square kilometers are located in the Pampanga River Basin, 1,810 sq. km in Agno River Basin, and 221 sq. km are in Porac-Gumain Potrero River basin. Urban centers occupy 405 square kilometer of these flood prone areas. Flooding in the region generally occurs between the months of July and December, and is normally due to the overflowing of the main river systems and tributaries during peak storm run-off. This is aggravated by the excessive sediment load, siltation in the mouth of waterways, inadequate riverbank stabilization, and man-made restrictions such as fishponds and dikes.

Earthquakes and Related Hazards

Earthquakes are caused by movement along active faults and subduction zones and within the subducting slab. The active faults in Region III are: the Philippine Fault Line which passes through Nueva Ecija, slicing from the north to the southeast towards Quezon province. This fault is commonly referred to as the Lingayen-Dinggalan Fault. Other faults are the extension of the Marikina Valley Fault System at Angat Bulacan, and possible active faults east and south of the Zambales Range.

Active subduction zones near the region are the Manila Trench, which is located about 120 kilometers west of the Zambales Range, and the East Luzon Trench located about 100 kilometers east of the Sierra Madre. Major earthquake generators outside Region III capable of producing earthquakes that could affect the region are: Casiguran Fault located offshore of Casiguran, Quezon; Philippine Fault extension north of region III; and Lubang Fault near Lubang Island and Mindoro Island.

2.2 SOCIO-ECONOMIC PROFILE

2.2.1 Population

During the past five years from 1990 to 1995, the population of Region III increased from 6.2 million to 6.9 million at the average annual growth rate of 2.26 % (see Table 2.2-1).

In *Bulacan Province*, the average annual growth rate of population of the municipalities along the Study Road is 3.52% which is higher than that of Bulacan Province. Especially municipalities of Plaridel, Pulilan and Pandi recorded high growth rate of more than 4%. The share of Bulacan Province in Region III expanded from 24.3% in 1990 to 25.7% in 1995. Municipalities along the Study Road and proposed bypass routes also increased the share from 9.9% to 10.4%.

In *Nueva Ecija Province*, the municipalities along the Study Road recorded an average annual growth rate of 2.87% and population of municipalities along the proposed bypass route grew at 2.75%. Population of San Leonardo, Munoz, San Jose City, and Cabanatuan City increased at the rate of more than 3%. The share of Nueva Ecija Province in Region III slightly increased from 21.2% in 1990 to 21.7% in 1995 and the share of the municipalities along the Study Road and proposed bypass route has also increased from 10.1% to 10.3%.

The characteristics of population of the Study Area are summarized as follows:

- The average population growth rate per annum of the Study Area (2.98%) was much higher than that of Region III (2.26%) and of the Philippines (2.48%).
- The population growth rate of Bulacan Province (3.46% per annum) was much higher than of Nueva Ecija (2.78% per annum).
- Bulacan Province is considered to be an area within a commuting zone to Metro Manila and will continue to grow with a high pace.

Figure 2.2-1 shows present population distribution.

TABLE 2.2-1 POPULATION TREND OF THE STUDY AREA

Province/ Region		Municipality	1990		1995		Growth Rate	
			Population	Share(%)	Population	Share(%)	1990=100	Average Annual (%)
Bulacan	Municipality along the Study Road	Plaridel	52,954	0.9	66,355	1.0	125	4.62
		Pulilan	48,119	0.8	59,682	0.9	124	4.40
		Baliuag	89,719	1.4	103,054	1.5	115	2.81
		San Rafael	49,528	0.8	58,387	0.8	118	3.35
		San Ildefonso	59,598	1.0	69,319	1.0	116	3.07
		San Miguel	91,124	1.5	108,147	1.6	119	3.48
		Sub-Total	391,042	6.3	464,944	6.7	119	3.52
	Municipality along the Proposed By-pass Route	Bustos	34,965	0.6	41,372	0.6	118	3.42
		Pandi	32,648	0.5	40,520	0.6	124	4.41
		Balagtas	42,658	0.7	49,210	0.7	115	2.90
		Bocaue	67,243	1.1	69,718	1.0	104	0.73
		Guiguinto	44,532	0.7	52,575	0.8	118	3.38
		Sub-Total	222,046	3.6	253,395	3.7	114	2.68
	Total (A)		**613,088**	**9.9**	**718,339**	**10.4**	**117**	**3.22**
	Total of Bulacan		**1,505,219**	**24.3**	**1,784,441**	**25.7**	**119**	**3.46**
Nueva Ecija	Municipality along the Study Road	Gapan	70,489	1.1	77,735	1.1	110	1.98
		San Leonardo	39,740	0.6	46,545	0.7	117	3.21
		Sta. Rosa	40,439	0.7	47,522	0.7	118	3.28
		Cabanatuan City	173,065	2.8	201,033	2.9	116	3.04
		Talavera	77,256	1.2	85,797	1.2	111	2.12
		Sto. Domingo	35,864	0.6	40,992	0.6	114	2.71
		Minoz	50,356	0.8	60,162	0.9	119	3.62
		San Jose City	82,836	1.3	96,860	1.4	117	3.18
		Sub-Total	570,045	9.2	656,646	9.5	115	2.87
	Municipality along the Proposed By-pass Route	San Isidro	34,349	0.6	36,283	0.5	106	1.10
		Penaranda	20,500	0.3	22,661	0.3	111	2.02
		Sub-Total	54,849	0.9	58,944	0.9	107	1.45
	Total (B)		**624,894**	**10.1**	**715,590**	**10.3**	**115**	**2.75**
	Total of Nueva Ecija		**1,312,610**	**21.2**	**1,505,827**	**21.7**	**115**	**2.78**
Total of Study Area (A)+(B)			**1,237,982**	**20.0**	**1,433,929**	**20.7**	**116**	**2.98**
Region III			6,199,017	100.0	6,932,570	100.0	112	2.26
Region I			3,550,642		3,803,890		107	1.39
Region II			2,340,545		2,536,035		108	1.62
Region IV			8,263,099		9,943,096		120	3.77
CAR			1,146,191		1,254,838		109	1.83
NCR			7,948,392		9,454,040		119	3.53
Philippines			**60,703,206**		**68,616,536**		**113**	**2.48**

Source: Census of Population and Household, 1990 & 1995, NSO

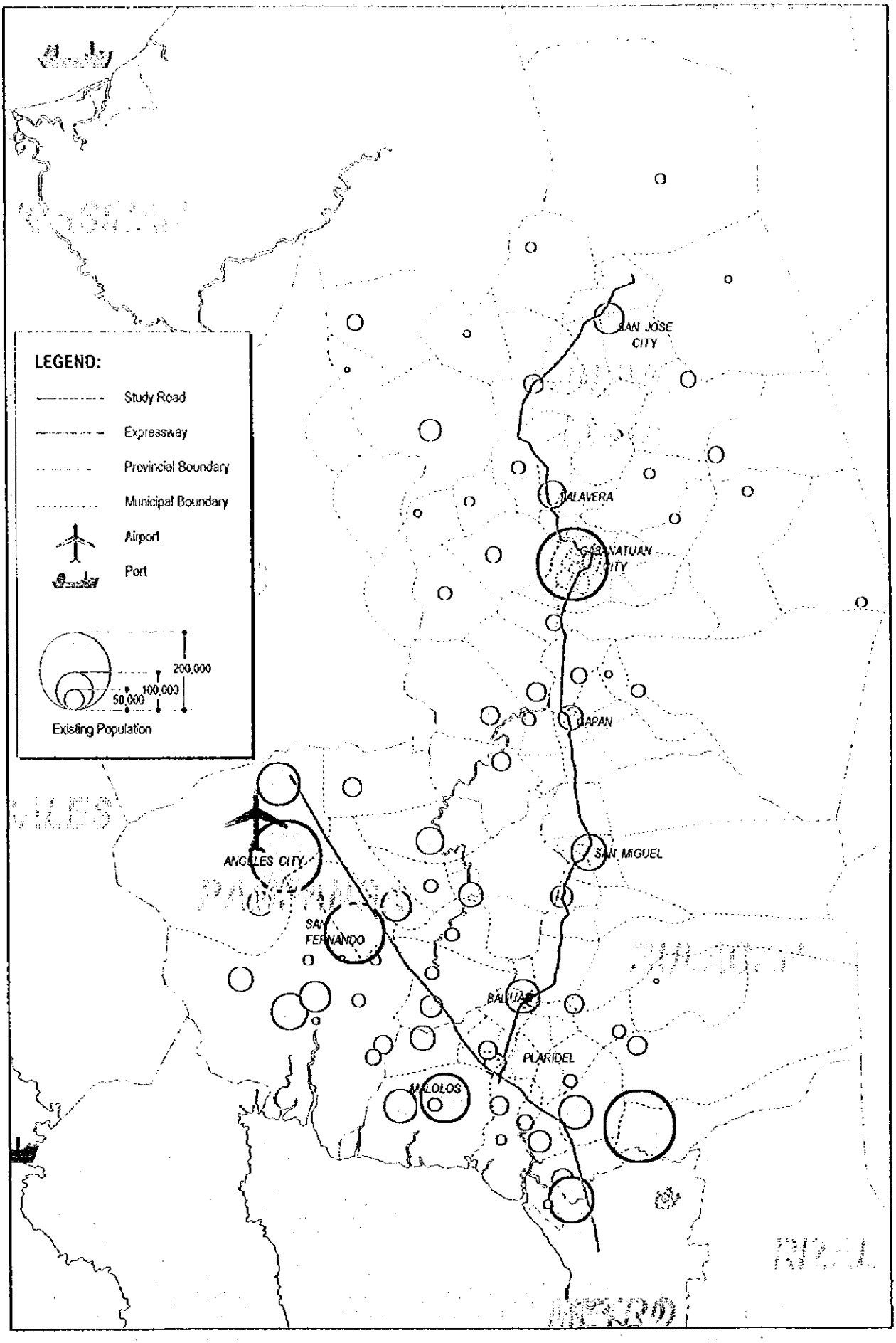


FIGURE 2.2-1 PRESENT POPULATION (1998)

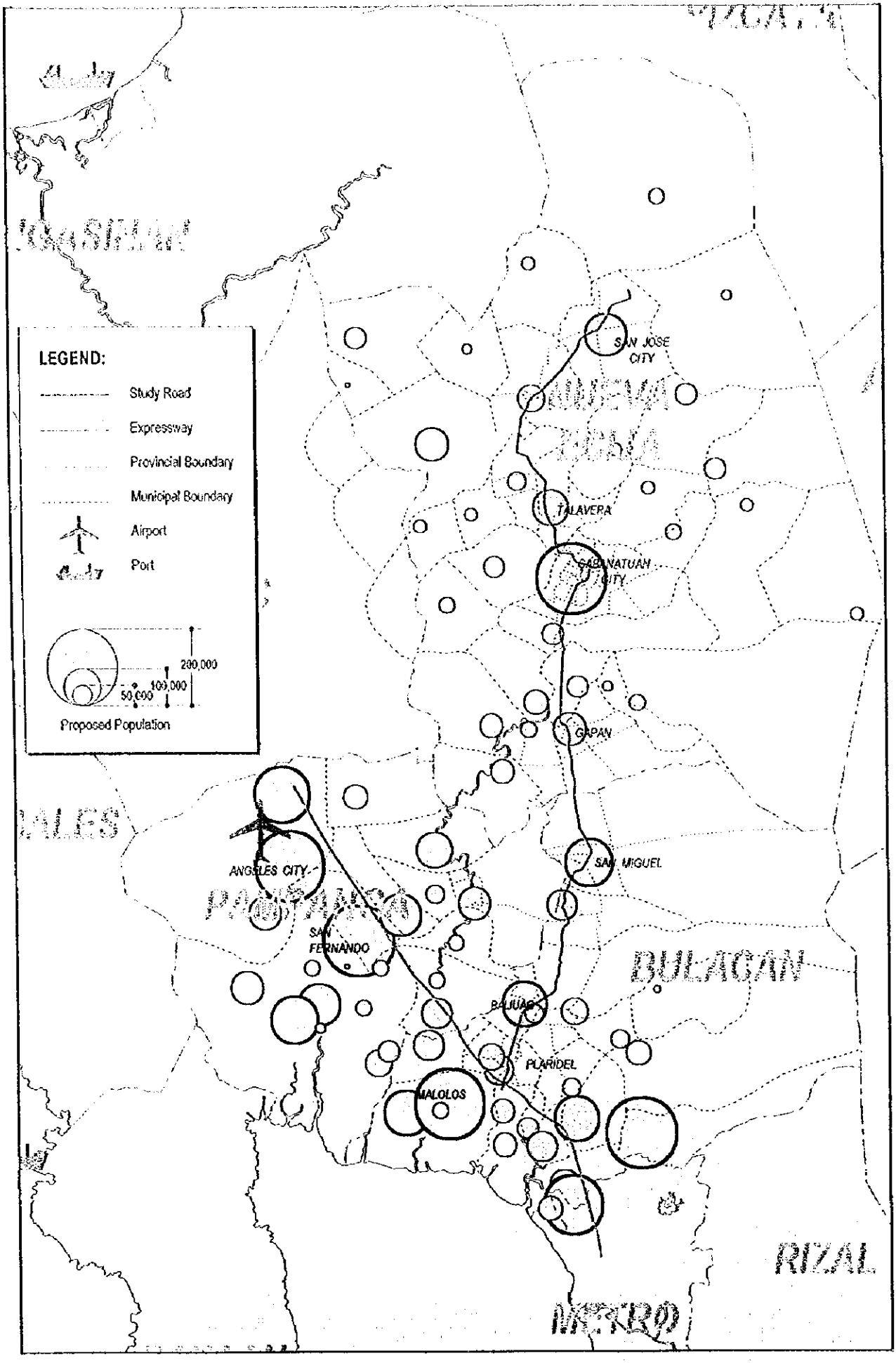


FIGURE 2.2-2 FUTURE POPULATION (2020)

2.2.2 Economy

(1) Gross Regional Domestic Project (GRDP)

Table 2.2-2 shows the historical performance of GRDP at current prices. Central Luzon Region (Region III) increased its GRDP from 59,992 million pesos to 202,671 million pesos during the ten years from 1987 to 1997. The share of Region III to the Philippines has slightly reduced in the same period from 8.8% to 8.4% but Region III still has the third largest share of any region in the country.

Table 2.2-3 shows the historical performance of GRDP at constant 1985 prices. In real price, Central Luzon Region (Region III) increased its GRDP from 57,459 million pesos to 86,779 million pesos at an average annual growth rate of 4.21% during the past ten years. The share of Region III to the Philippines in real price has slightly expanded from 9.3% in 1987 to 9.7% in 1997. The GRDP characteristics of Region III are summarized as follows:

- The growth rate is in the fourth rank in the Philippines.
- It has the third largest GRDP following Metro Manila and Southern Tagalog (Region IV)

The historical performance of per capita GRDP at constant 1985 prices is shown in Table 2.2-4. In real prices, the per capita GRDP of Region III increased from 10,035 pesos in 1987 to 11,954 pesos in 1997 with an average annual growth rate of 1.45%. This is higher than that of the Philippines (1.22%) as a whole.

(2) Employment

Table 2.2-5 shows the number of people employed in the Study Area in 1995. In Region III, the total employment was 2.4 million or 10.1% of the total employment in the Philippines.

Total employment of the Study Area was 476,997 or 19.6% of Region III.

(3) Incidence of Poor Families

The incidence of poor families of the Philippines was 39.9% in 1988. This improved to 32.1% in 1997. In Region III, the incidence of poor families drastically improved from 31.1% in 1988 to 16.8% in 1997, though this is still about twice that in Metro Manila (see Table 2.2-6).

TABLE 2.2-2 HISTORICAL PERFORMANCE OF GRDP AT CURRENT PRICES

(Unit: Million Pesos at Current Prices)

Region		1987		1992		1997		Average Annual Growth Rate (%)		
			Share(%)		Share(%)		Share(%)	1987/92	1992/97	1987/97
3	***Central Luzon***	***59,992***	***8.8***	***116,202***	***8.7***	***202,671***	***8.4***	***14.53***	***11.39***	***12.95***
NCR	Metro Manila	208,661	30.6	437,730	32.4	835,638	34.5	15.97	13.81	14.88
CAR	Cordillera Administrative F	13,691	2.0	23,974	1.8	50,663	2.1	11.86	16.14	13.98
1	Ilocos Region	20,385	3.0	37,102	2.7	75,004	3.1	12.72	15.12	13.91
2	Cagayan Valley	14,280	2.1	26,671	2.0	49,653	2.0	13.31	13.24	13.27
4	Southern Tagalog	95,946	14.1	205,172	15.2	341,670	14.1	16.42	10.74	13.54
5	Bicol Region	20,607	3.0	39,616	2.9	69,858	2.9	13.96	12.01	12.98
6	Western Visayas	48,890	7.2	95,299	7.1	162,054	6.7	14.28	11.20	12.73
7	Central Visayas	43,326	6.3	88,831	6.6	157,781	6.5	15.44	12.18	13.80
8	Eastern Visyasas	18,139	2.7	34,681	2.6	60,045	2.5	13.84	11.60	12.72
9	Western Mindanao	20,900	3.1	39,012	2.9	60,902	2.5	13.29	9.32	11.29
10	Northern Mindanao	37,920	5.6	68,855	5.1	114,038	4.7	12.67	10.62	11.64
11	Southern Mindanao	54,132	7.9	90,297	6.7	155,366	6.4	10.78	11.46	11.12
12	Central Mindanao	25,897	3.8	46,118	3.4	65,880	2.7	12.23	7.39	9.79
ARM M	Autonomous Region of Muslim Mindanao	-		-		22,418	0.9	-	-	-
	Philippines	682,765	100.0	1,351,559	100.0	2,423,640	100.0	14.63	12.39	13.51

Source:1. Philippine Statistical Yearbook,1998, NSCB

TABLE 2.2-3 HISTORICAL PERFORMANCE OF GRDP AT CONSTANT 1985 PRICES

(Unit: Million Pesos at Constnt 1985 Prices)

Region		1987		1992		1997		Average Annual Growth Rate (%)		
			Share(%)		Share(%)		Share(%)	1987/92	1992/97	1987/97
3	***Central Luzon***	***57,459***	***9.3***	***70,736***	***9.8***	***86,779***	***9.7***	***4.25***	***4.17***	***4.21***
NCR	Metro Manila	180,609	29.3	215,465	30.0	275,508	30.9	3.59	5.04	4.31
CAR	Cordillera Administrative F	11,342	1.8	13,591	1.9	19,443	2.2	3.68	7.42	5.54
1	Ilocos Region	18,294	3.0	20,334	2.8	27,210	3.0	2.14	6.00	4.05
2	Cagayan Valley	13,087	2.1	13,974	1.9	18,191	2.0	1.32	5.42	3.35
4	Southern Tagalog	90,978	14.7	113,545	15.8	139,192	15.6	4.53	4.16	4.34
5	Bicol Region	18,913	3.1	21,902	3.1	25,773	2.9	2.98	3.31	3.14
6	Western Visayas	44,858	7.3	53,331	7.4	62,925	7.0	3.52	3.36	3.44
7	Central Visayas	39,662	6.4	47,086	6.5	58,647	6.6	3.49	4.49	3.99
8	Eastern Visyasas	16,175	2.6	17,088	2.4	20,654	2.3	1.10	3.86	2.47
9	Western Mindanao	19,191	3.1	21,186	2.9	23,121	2.6	2.00	1.76	1.88
10	Northern Mindanao	34,381	5.6	37,345	5.2	44,310	5.0	1.67	3.48	2.57
11	Southern Mindanao	48,383	7.8	48,953	6.8	58,596	6.6	0.23	3.66	1.93
12	Central Mindanao	23,592	3.8	24,396	3.4	24,042	2.7	0.67	-0.29	0.19
ARM M	Autonomous Region of Muslim Mindanao	-	-	-	-	8,626	1.0	-	-	-
	Philippines	616,926	100.0	718,942	100.0	893,017	100.0	3.11	4.43	3.77

Source:1. Philippine Statistical Yearbook,1998, NSCB

TABLE 2.2-4 HISTORICAL PERFORMANCE OF PER CAPITA GRDP

(Unit:Pesos at Constnt 1985 Prices)

Region		1987		1992		1997		Average Annual Growth Rate (%)		
			Share(%)		Share(%)		Share(%)	1987/92	1992/97	1987/97
3	***Central Luzon***	***10,035***	***9.3***	***11,013***	***9.8***	***11,594***	***9.5***	***1.88***	***1.03***	***1.45***
NCR	Metro Manila	24,559	22.8	25,712	23.0	29,047	23.9	0.92	2.47	1.69
CAR	Cordillera Administrative F	10,522	9.8	11,326	10.1	13,948	11.5	1.48	4.25	2.86
1	Ilocos Region	5,497	5.1	5,581	5.0	6,503	5.4	0.30	3.11	1.69
2	Cagayan Valley	5,695	5.3	5,399	4.8	6,414	5.3	-1.06	3.51	1.20
4	Southern Tagalog	12,150	11.3	13,324	11.9	13,620	11.2	1.86	0.44	1.15
5	Bicol Region	4,607	4.3	4,781	4.3	5,511	4.5	0.74	2.88	1.81
6	Western Visayas	8,427	7.8	9,032	8.1	9,818	8.1	1.40	1.68	1.54
7	Central Visayas	9,093	8.5	9,838	8.8	10,652	8.8	1.59	1.60	1.60
8	Eastern Visyasas	5,078	4.7	4,909	4.4	5,594	4.6	-0.67	2.65	0.97
9	Western Mindanao	6,410	6.0	6,362	5.7	7,593	6.3	-0.15	3.60	1.71
10	Northern Mindanao	10,263	9.5	9,835	8.8	10,238	8.4	-0.85	0.81	-0.02
11	Southern Mindanao	12,000	11.2	10,787	9.6	10,529	8.7	-2.11	-0.48	-1.30
12	Central Mindanao	8,632	8.0	7,908	7.1	9,563	7.9	-1.74	3.87	1.03
ARM M	Autonomous Region of Muslim Mindanao	-	-	-	-	3,944	3.2	-	-	-
	Philippines	10,756	100.0	11,188	100.0	12,145	100.0	0.79	1.66	1.22

Source:1. Philippine Statistical Yearbook,1998, NSCB

TABLE 2.2-5 EMPLOYMENT IN THE STUDY AREA(1995)

(Unit: Person)

Province/Region		Municipality	Total Employment	Share(%)
Bulacan	Municipality along the Study Road	Plaridel	23,934	1.0
		Pulilan	21,563	0.9
		Baliuag	37,217	1.5
		San Rafael	21,031	0.9
		San Ildefonso	25,026	1.0
		San Miguel	39,007	1.6
		Sub-Total	167,778	6.9
	Municipality along the Proposed Bypass Route	Bustos	14,943	0.6
		Pandi	14,490	0.6
		Balagtas	17,772	0.7
		Bocaue	25,182	1.0
		Guiguinto	18,887	0.8
		Sub-Total	91,275	3.8
		Total (A)	259,053	10.7
	Total of Bulacan		643,633	26.5
Nueva Ecija	Municipality along the Study Road	Gapan	26,301	1.1
		San Leonardo	15,746	0.6
		Sta. Rosa	16,080	0.7
		Cabanatuan City	67,548	2.8
		Talavera	6,130	0.3
		Sto. Domingo	13,870	0.6
		Minoz	20,313	0.8
		San Jose City	32,761	1.3
		Sub-Total	198,749	8.2
	Municipality along the Proposed Bypass Route	San Isidro	12,277	0.5
		Penaranda	6,918	0.3
		Sub-Total	19,195	0.8
		Total (B)	217,944	9.0
	Total of Nueva Ecija		508,773	20.9
	Total of Study Area (A)+(B)		**476,997**	**19.6**
Region III			2,428,710	100.0
Region I			1,471,400	
Region II			1,207,800	
Region IV			3,516,600	
CAR			544,300	
NCR			3,118,772	
Philippines			25,700,300	

Source: 1. The Countryside in Figures, Oct. 1998, NSCB
2. Philippine Statistical Yearbook, 1998, NSCB

TABLE 2.2-6 INCIDENCE OF POOR FAMILIES BY REGION

Region		1988			1997		
		Annual Poverty Threshold [a] (Pesos)	Magnitude of Poor Families [b]	Incidence of Poor Families [c]	Annual Poverty Threshold (Pesos)	Magnitude of Poor Families	Incidence of Poor Families
3	***Central Luzon***	***8,173***	***371,817***	***31.1***	***12,837***	***241,865***	***16.8***
NCR	Metro Manila	9,286	217,602	13.2	14,360	140,793	7.1
Area	Outside NCR	6,982	4,563,266	44.2	10,898	4,412,594	36.2
CAR	Cordillera Administrative Region	8,332	111,030	48.8	12,744	109,646	42.3
1	Ilocos Region	8,060	325,145	48.4	11,981	292,764	37.6
2	Cagayan Valley	7,035	211,289	43.3	9,873	185,768	31.6
4	Southern Tagalog	8,075	612,213	37.9	12,507	498,536	25.7
5	Bicol Region	6,385	452,777	55.0	10,497	485,099	50.1
6	Western Visayas	6,403	484,505	45.3	10,558	520,200	41.6
7	Central Visayas	5,585	377,448	41.7	8,726	357,715	34.2
8	Eastern Visyasas	5,138	264,906	40.1	8,755	305,750	40.7
9	Western Mindanao	6,351	238,022	49.7	9,670	221,330	39.8
10	Northern Mindanao	6,433	363,231	53.0	10,455	385,337	46.8
11	Southern Mindanao	6,544	383,368	46.2	10,489	379,344	37.9
12	Central Mindanao	7,321	209,458	57.0	11,155	220,526	49.1
ARMM	Autonomous Region of Muslim Mindanao	7,450	157,507	50.7	11,214	208,714	58.6
	Philippines	7,302	4,780,868	39.9	10,756	4,553,387	32.1

Source : Technical Working Group on Income Statistics, NSCB
Note: a) The annual per capita income required or the amount to be spent to satisfy nutritionql requiremens (2,000 calories) and other basic needs
b) The number of families whose annual per capita income falls below the annual per capita poverty threshold.
c) The proportion of poor families to total number of families

2.2.3 Industrial Structure of Region III

The industrial structure of Region III is shown in Table 2.2-7 (that of all Regions is presented in Appendix 2.2-1).

Region III's of GDP increased from 9.3% in 1987 to 9.7% in 1997 with an average growth rate of 4.2% per annum which was higher than the GDP growth rate of 3.8%. By the industrial origin, the agriculture sector produced 10.4%, the industry sector 12.0% and the service sector 7.5% of country's economic output.

In Region III, the industry sector has the highest share (44.2%) of the economic output, which is quite high compared to the national average of 35.9%. During the past 10 years, a high annual growth rate of 5.0% was recorded by the industry sector.

The agriculture sector produced 22.1% of Region III's GRDP and 10.4% of national agricultural economic output. The agricultural sector recorded a high annual growth rate of 4.0% per annum in the past 10 years which is quite high compared to the national average of 2.1%.

The share of the service sector in Region III's GRDP is rather low at 33.7% compared with the national average of 43.4%.

TABLE 2.2-7 INDUSTRIAL STRUCTURE OF REGION III

	Industrial Origin	GRDP by Industrial Origin (1985 Constant Prices in Million P)		Average Growth Rate Per Annum: 1987-1997 (%)
		1987	1997	
Region III	Agriculture	12,944 (22.5%) [8.6%]	19,180 (22.1%) [10.4%]	4.0%
	Industry	23,571 (41.0%) [11.0%]	38,377 (44.2%) [12.0%]	5.0%
	Service	20,945 (36.5%) [8.3%]	29,222 (33.7%) [7.5%]	3.4%
	Total	57,460 (100%) [9.3%]	86,779 (100%) [9.7%]	4.2%
Philippines	Agriculture	150,414 (24.4%) [100%]	184,713 (20.7%) [100%]	2.1%
	Industry	213,389 (34.6%) [100%]	320,689 (35.9%) [100%]	4.2%
	Service	253,121 (41.0%) [100%]	387,616 (43.4%) [100%]	4.4%
	Total	616,924 (100%) [100%]	893,018 (100%) [100%]	3.8%

Source: Philippine Statistical Yearbook, 1998 (NSCB)

2.3 LAND USE AND DEVELOPMENT PLAN

2.3.1 Present Land Use

Table 2.3-1 shows the present land use of Provinces of Bulacan and Nueva Ecija through which the Study Road passes. The predominant land use is agricultural and forestry production land, accounting for about 62% of the area. Rice fields have a high percentage of about 38%. Protected areas, which are mostly reserved forests, occupy about 25% of the land. These areas are found far from the Study Road in the eastern parts of the two provinces.

TABLE 2.3-1 PRESENT LAND USE BY PROVINCE

Land Use Type	Bulacan		Nueva Ecija		Total	
	Area (ha.)	(%)	Area (ha.)	(%)	Area (ha.)	(%)
I. Production land use	168,812	64.3	319,427	60.4	488,239	61.7
1) Crop land	144,648	55.1	311,630	59.0	456,278	57.7
- Rice	70,718	26.9	228,473	43.2	299,191	37.8
- Corn	2,563	1.0	971	0.2	3,534	0.4
- Vegetable	788	0.3	7,698	1.5	8,486	1.1
- Fruits	8,506	3.2	4,306	0.8	12,812	1.6
- Plantation	398	0.2	854	0.2	1,252	0.2
- Forage crop	61,675	23.5	69,010	13.1	130,685	16.5
- Pyroclastic	-	0.0	318	0.1	318	0.0
2) Fishing ground	16,664	6.3	197	0.0	16,861	2.1
3) Production forest	7,500	2.9	7,600	1.4	15,100	1.9
II. Protected area	69,667	26.5	125,809	23.8	195,476	24.7
III. Built-up area	24,021	9.2	83,197	15.7	107,218	13.6
Total land area	262,500	100.0	528,433	100.0	790,933	100.0

Figure 2.3-1 shows the present land use map which was prepared based on data submitted by the municipalities and cities along the Study Road. In the flatland, the predominant land use is ricefields. Residential areas are developing along existing roads, especially along the Study Road.

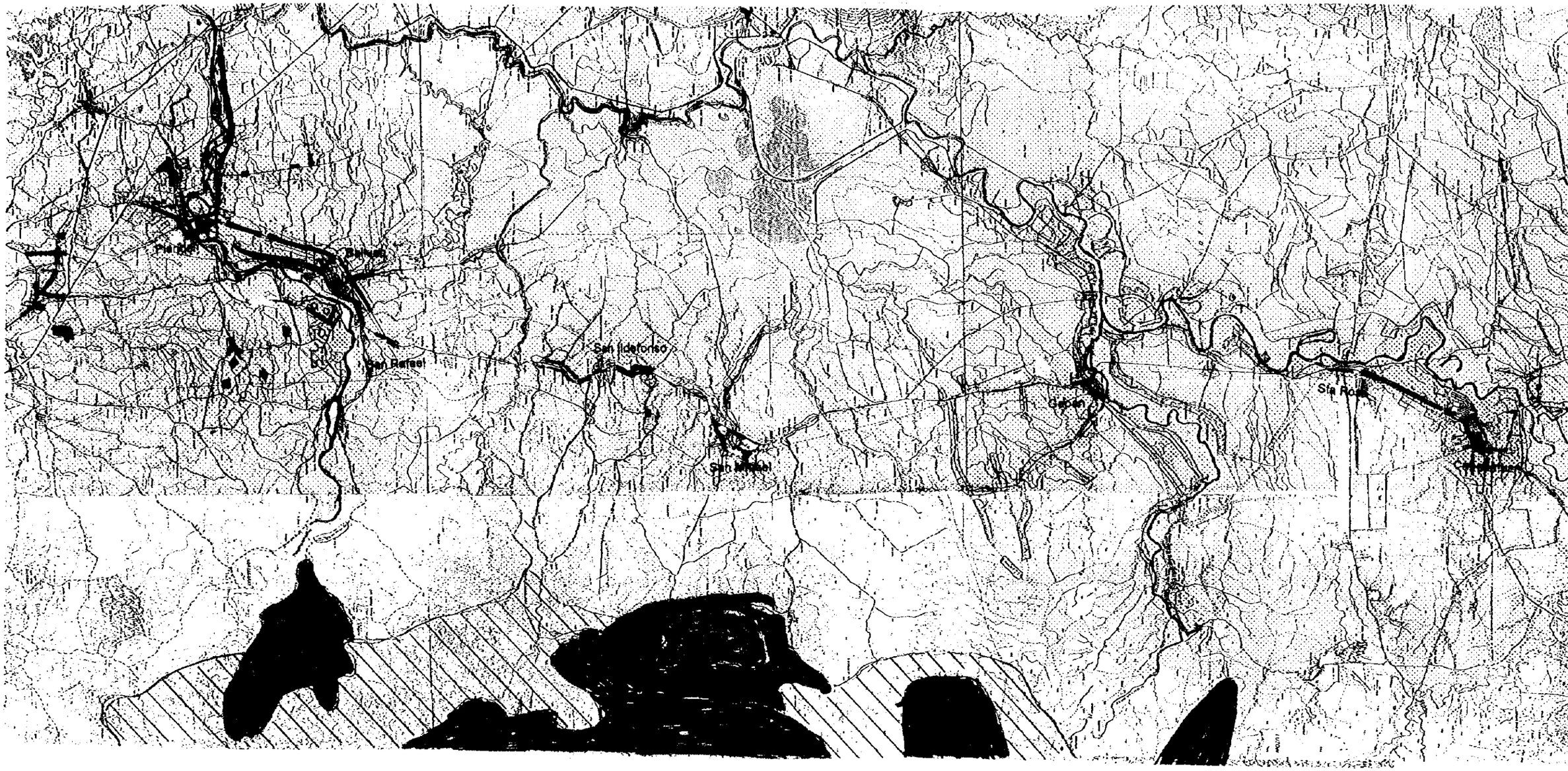
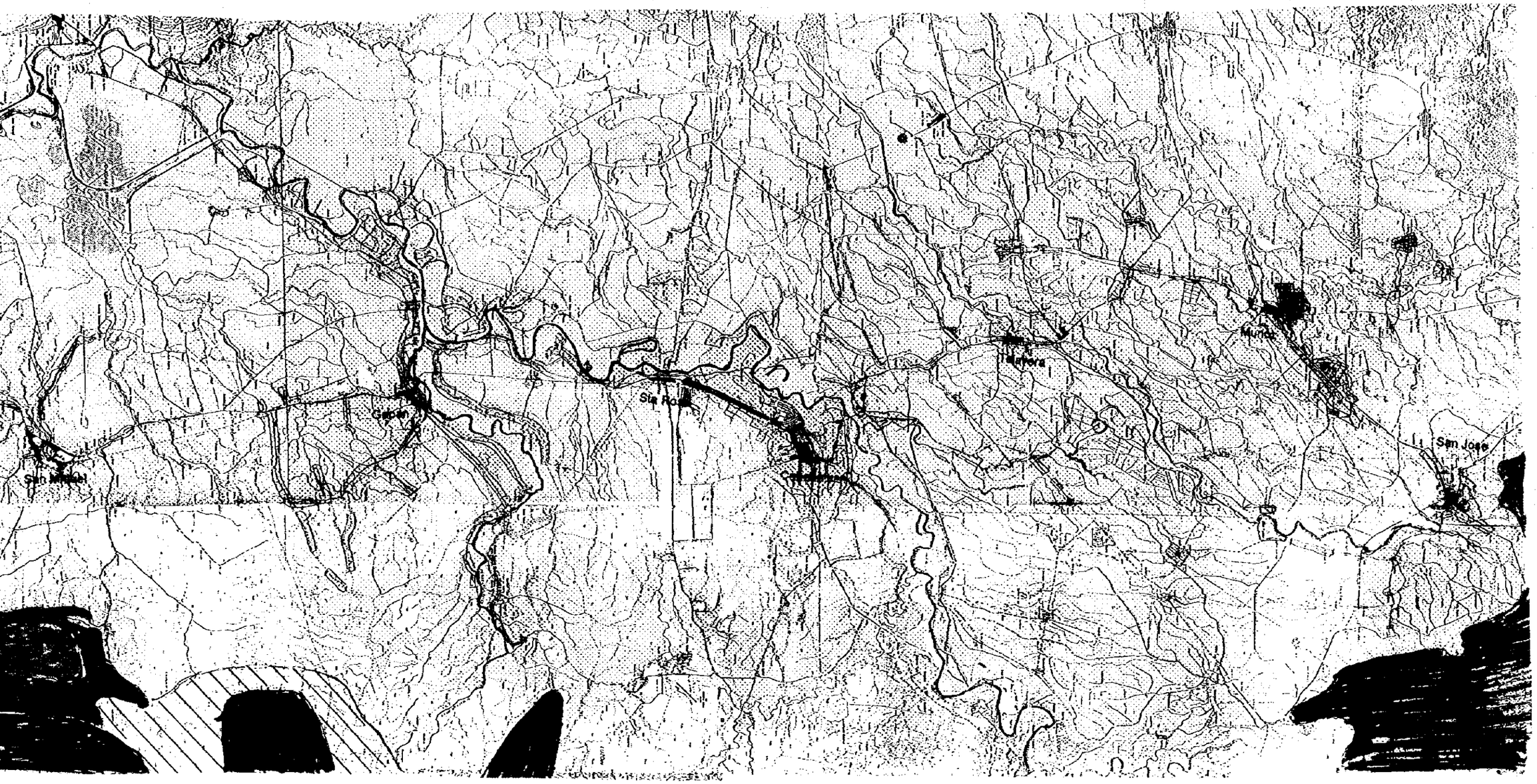


FIGURE 2.3-1 PRESENT LAND USE MAP



LEGEND :

- Commercial Area
- Residential Area
- Industrial Area
- Institutional Area
- Rice Field
- Reserved Forest
- Productive Forest
- National Park
- Mining Area

FIGURE 2.3-1 PRESENT LAND USE MAP