

REPUBLIC OF THE PHILIPPINES  
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

**Feasibility Study**  
**on**  
**The Rural Road Network Development Project**

FINAL REPORT (Volume 2)

MAIN REPORT

OCTOBER, 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

REPUBLIC OF THE PHILIPPINES

Feasibility Study on the Rural Road  
Network Development Project

FINAL REPORT  
(Volume 2)

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DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

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国際協力事業団

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## PREFACE

In response to the request from the Government of the Republic of the Philippines, the Japanese Government decided to conduct a study on the Feasibility Study on the Rural Road Network Development Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines a study team headed by Mr. Kunihiko Sawano, composed of members from the Katahira & Engineers Inc. and Nippon Engineering Consultant Co., Ltd., two times from October 1989 to October 1990.

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

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

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

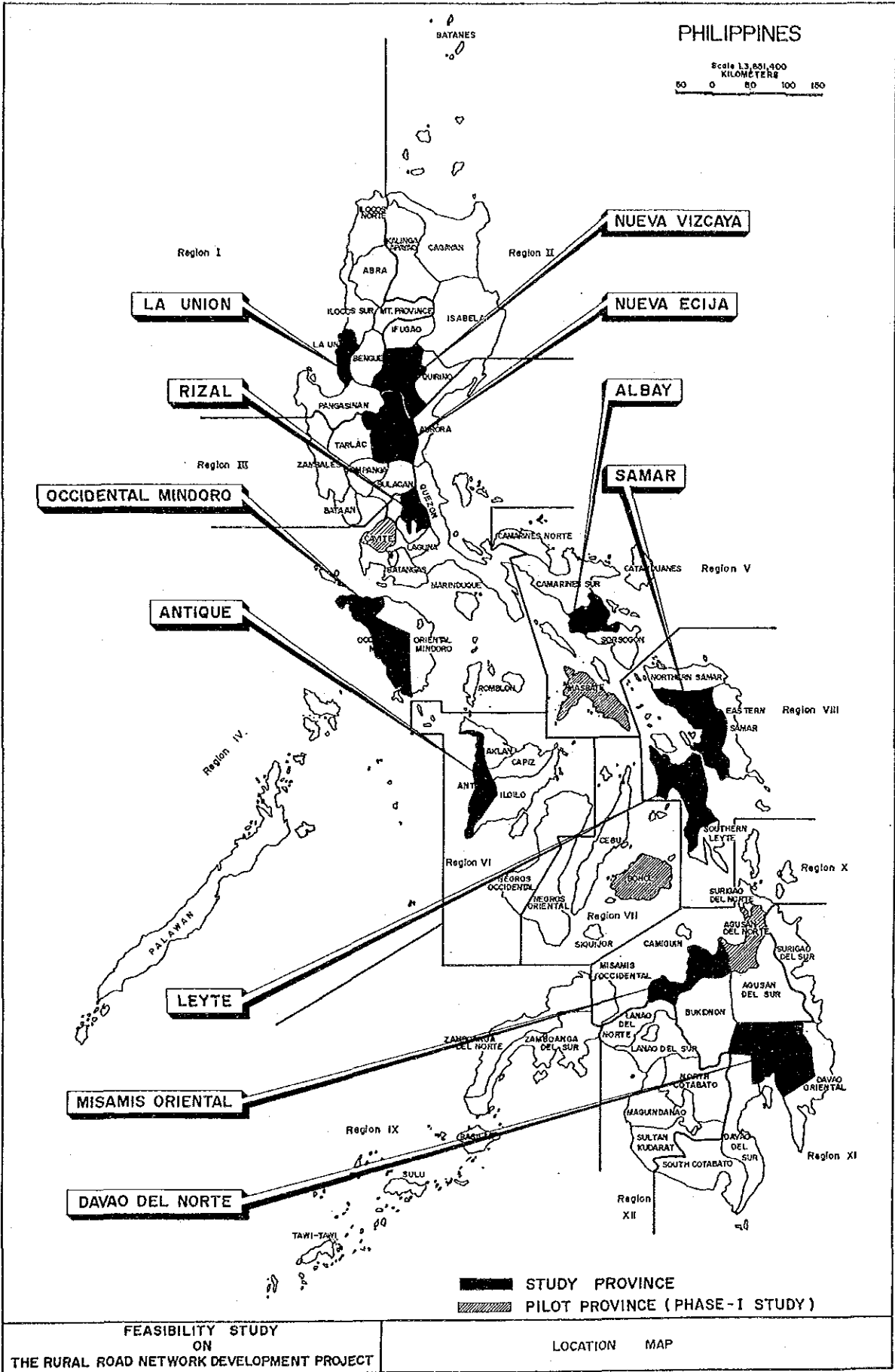
October, 1990



Kensuke Yanagiya  
President  
Japan International Cooperation Agency











Panabo-Tubod Road, Davao del Norte  
PCC pavement in fair condition



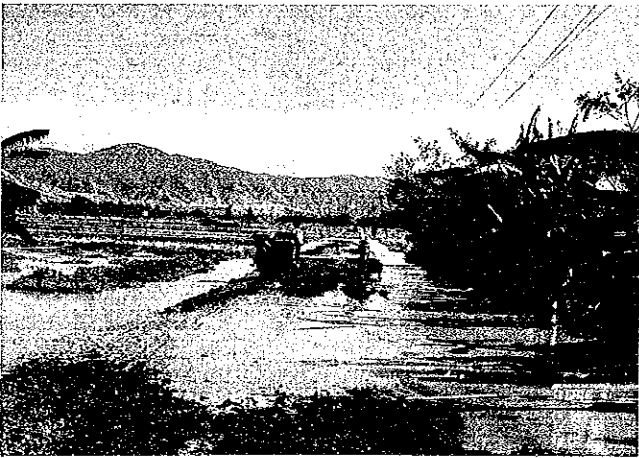
Bacnotan-Luna-Balaoan Road, La Union  
DBST pavement in fair condition



Mamburao South Road, Occidental Mindoro  
Gravel road in fair condition



Kasibu-Quezon-Solano Road, Nueva Vizcaya  
Gravel road in poor condition



Nueva Ecija-Aurora Road, Nueva Ecija  
Gravel road at flooded section

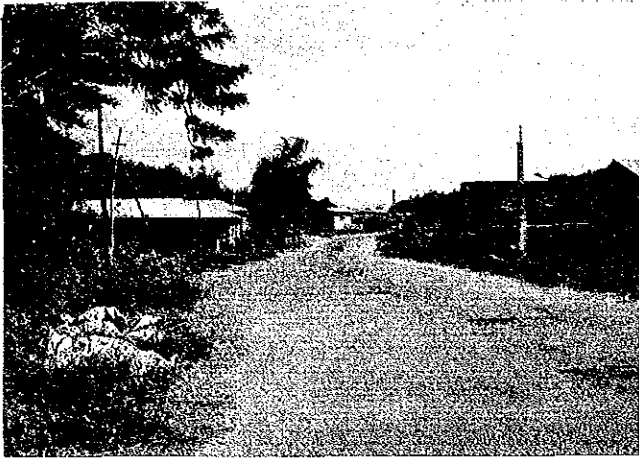


San Juanico-Sohoton Road, Samar  
Earth road

## RURAL ROADS IN THE PHILIPPINES

National Road





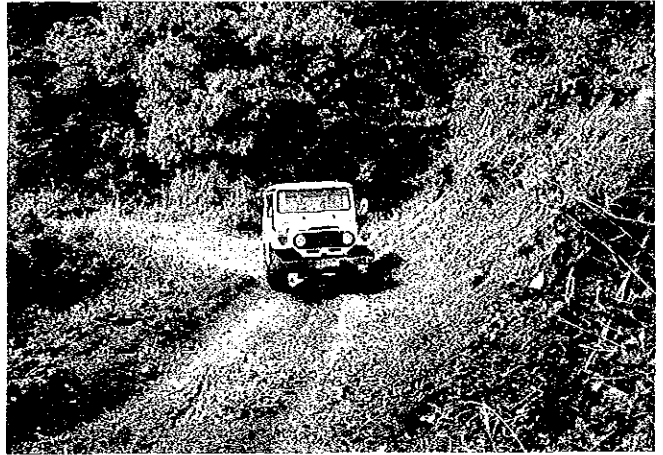
Morong-Bonbongan Road, Rizal  
DBST pavement in fair condition



San Jorge-Matalud Road, Samar  
Gravel road in fair condition



Guimba-Talugtog Road, Nueva Ecija  
Gravel road in bad condition



Aringay-San Jose Road, La Union  
At slope failure section



Ben-San Antonio road, Antique  
At flooded section



Sto. Nino-Aguas Road, Occidental Mindoro  
At impassable section

## RURAL ROADS IN THE PHILIPPINES

Provincial Road





Camalig-Taladong Road, Albay  
Gravel road in bad condition



Binuangan-Kidampis Road, Misamis Oriental  
Gravel road in very bad and narrow section



New Bataan-Camanlagan Road, Davao del Norte  
At ford crossing



Matiang-San Jose de Buan Road, Samar  
At steep section



San Mariano Road, Leyte  
Earth road in poor condition



Balac-Balac Road, Antique  
Earth road impassable for vehicles

## RURAL ROADS IN THE PHILIPPINES

### Barangay Road



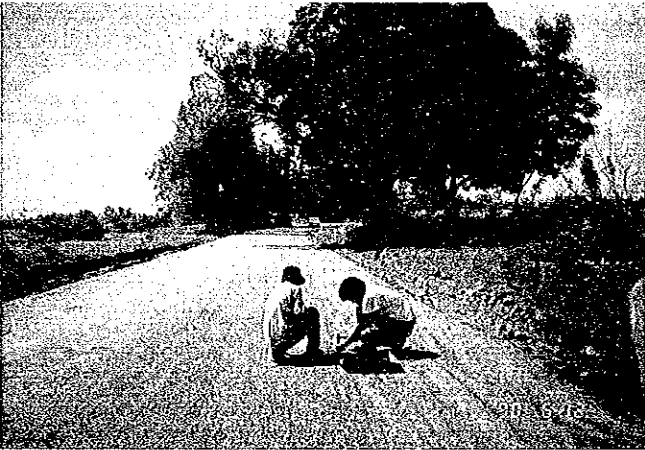




Spreading of sandy gravel subbase course materials for compaction



Compaction of subbase course materials



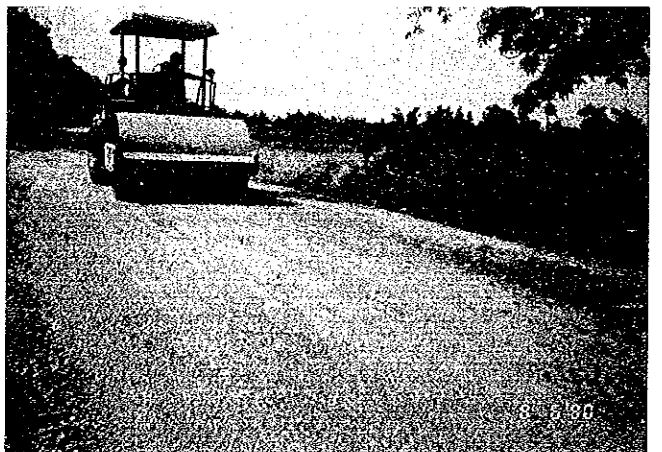
Conducting of field density tests on a prepared subbase course



Spreading of crushed stone base course materials for compaction



Watering of base course for compaction



Compaction of base course materials

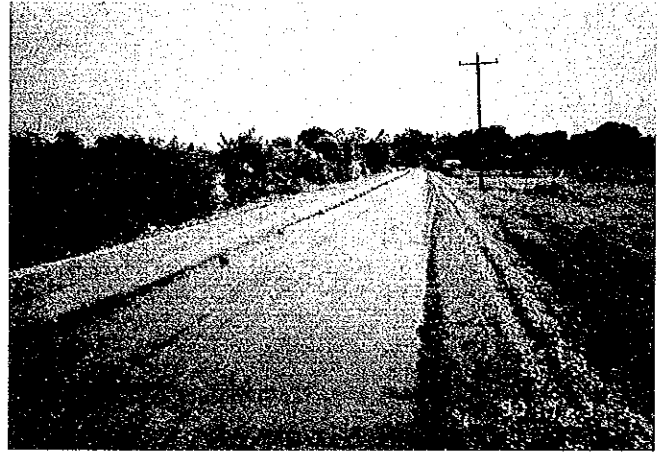
## EXPERIMENTAL PAVEMENT CONSTRUCTION

### Subbase Course and Base Course





Prepared base course before prime coating



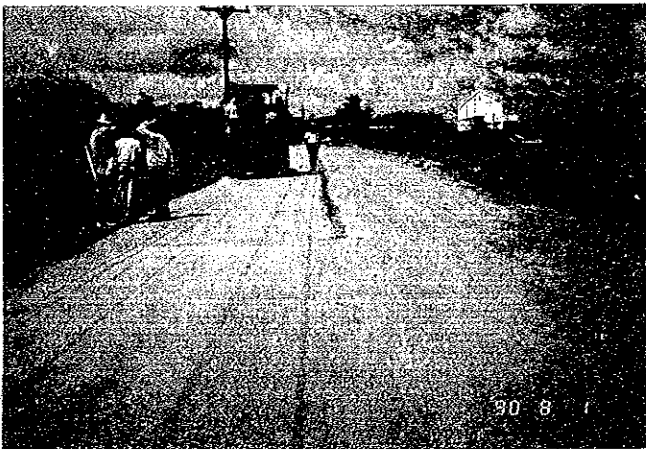
Base course after prime coating



Double bituminous surface treatment, asphalt binder spraying by asphalt distributor



Double bituminous surface treatment, cover aggregate spreading by aggregate spreader



Final rolling of double bituminous surface treatment

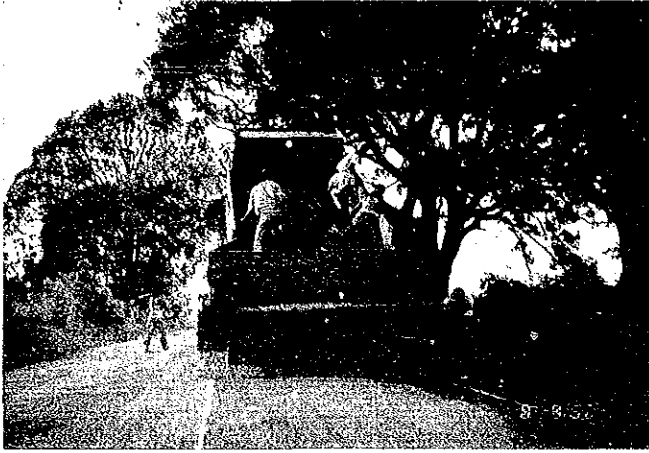


Finished double bituminous surface treatment (left) and stone layer rolling (right)

## EXPERIMENTAL PAVEMENT CONSTRUCTION

### Double Bituminous Surface Treatment

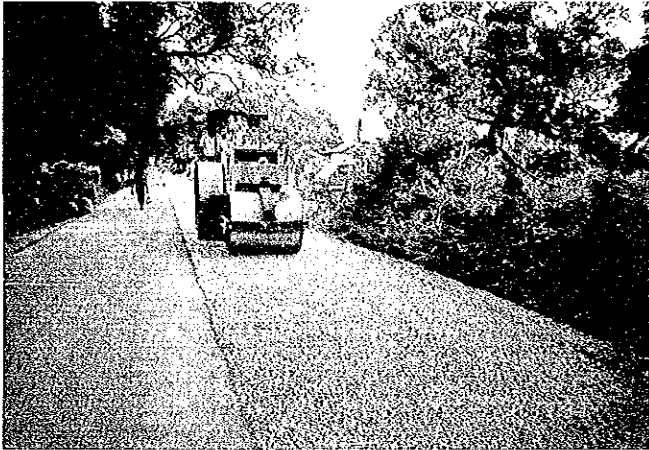




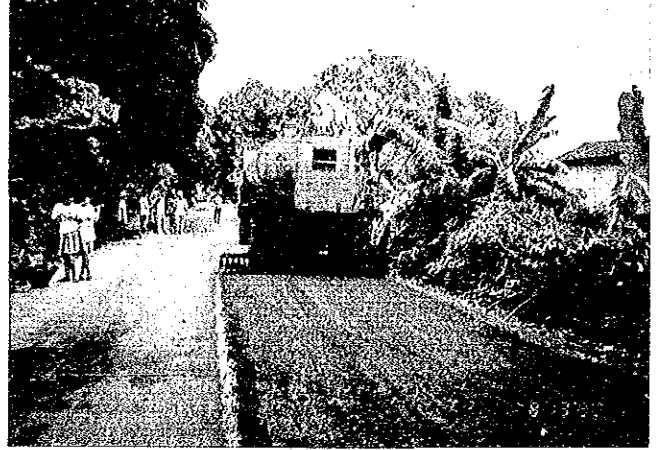
Bituminous penetration macadam,  
base layer aggregate spreading by aggregate spreader



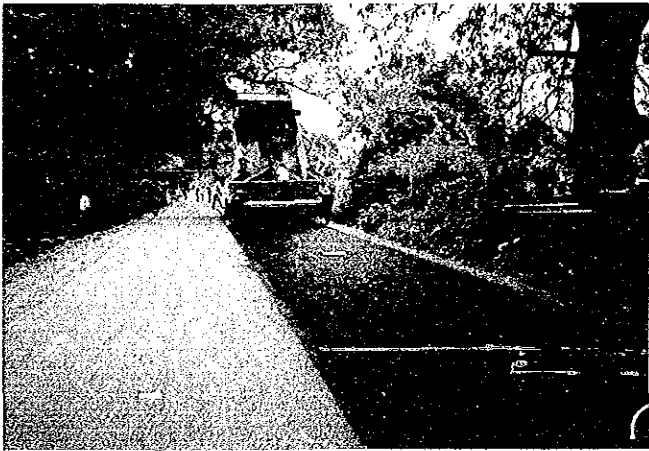
Bituminous penetration macadam,  
base layer aggregate spreading by hand



Bituminous penetration macadam, base layer compaction



Bituminous penetration macadam,  
asphalt binder spraying by asphalt distributor



Bituminous penetration macadam,  
cover aggregate spreading



Finished bituminous penetration macadam (left)  
and stone layer rolling (right)

## EXPERIMENTAL PAVEMENT CONSTRUCTION

### Bituminous Penetration Macadam





Laying of asphalt concrete by asphalt finisher



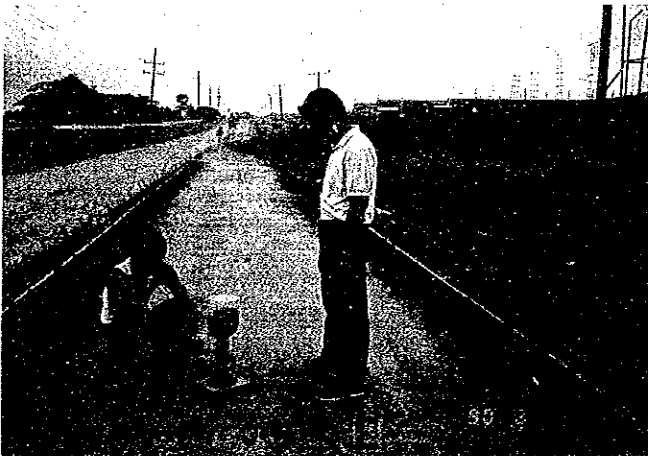
Rolling of asphalt concrete (left)  
and finished asphalt concrete surface course (right)



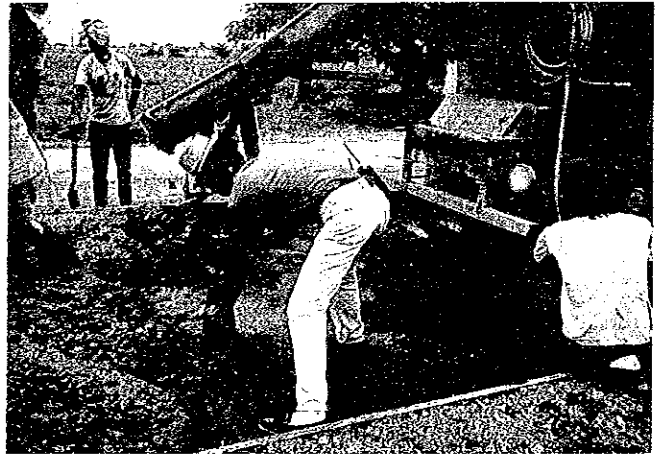
Setting of wooden side forms for portland cement concrete  
surface course



Compaction of trimmed subbase course



Conducting of field density tests for compacted subbase course



Starting of placement of cement concrete and slump tests

## EXPERIMENTAL PAVEMENT CONSTRUCTION

Asphalt Concrete Surface Course and Portland Cement Concrete Surface Course







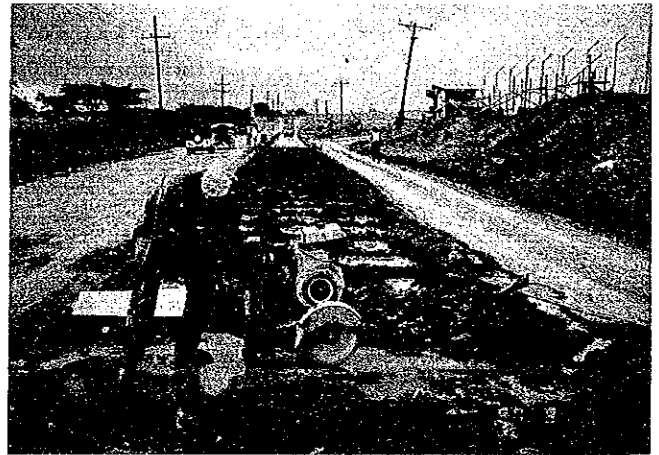
Placing of cement concrete



Finishing of cement concrete surface



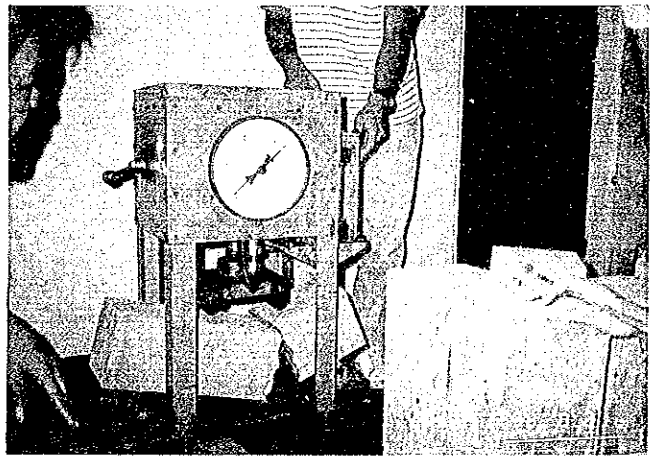
Water curing of hardened concrete



Saw cutting for transverse contraction joints



Curing of concrete beam-test samples in curing tank



Breaking of concrete beam test samples

## EXPERIMENTAL PAVEMENT CONSTRUCTION

### Portland Cement Concrete Surface Course



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## ABBREVIATIONS

AADT	-	Average Annual Daily Traffic
ADT	-	Average Daily Traffic
AASHTO	-	American Association of State Highway and Transportation Officials
AC	-	Asphalt Concrete Pavement
ADB	-	Asian Development Bank
BCGS	-	Bureau of Coast and Geodetic Survey
BDC	-	Barangay Development Council
BHS	-	Barangay Health Station
BMP	-	Bituminous Penetration Macadam Pavement
BOC	-	Bureau of Construction
BOD	-	Bureau of Design
BOE	-	Bureau of Equipment
BOM	-	Bureau of Maintenance
BRS	-	Bureau of Research and Standard
CCT	-	Community Construction Team
CEO	-	City Engineer's Office
CLATT	-	Central Labor-based Advisory and Training Team
DBM	-	Department of Budget and Management
DBST	-	Double Bituminous Surface Treatment
DEO	-	District Engineer's Office
DLG	-	Department of Local Government
DPWH	-	Department of Public Works and Highways
EO	-	Executive Order
ESAL	-	Egivalent Single Axle Load
EMK	-	Equivalent Maintenance Kilometer
F/S	-	Feasibility Study
GDP	-	Gross Domestic Products
GNP	-	Gross National Products
GR	-	Gravel Surfaced Road
GRDP	-	Gross Regional Domestic Products
HAC	-	Hot mix Asphalt Concrete
IBRD	-	International Bank for Reconstruction and Development
IRR	-	International Rate of Return
JICA	-	Japan International Cooperation Agency
LGU	-	Local Government Unit
MAO	-	Municipal Agricultural Office
MDC	-	Municipal Development Council
MEO	-	Municipal Engineer's Office
MPDC	-	Municipal Planning and Development Coordinator
MPI	-	Minor Road Pre-evaluation Indicator
NALGU	-	National Aid to Local Government Unit
NCR	-	National Capital Region
NCSO	-	National Census and Statistics Office
NEDA	-	National Economic and Development Authority
NTCP	-	Nationwide Traffic Count Program
OD	-	Origin-Destination

PBAC	-	Prequalification, Bids and Awards Committee
PCC	-	Portland Cement Concrete Pavement
PD	-	Presidential Decree
PDC	-	Provincial Development Council
PEO	-	Provincial Engineer's Office
PEVAC	-	Prequalification, Evaluation and Award Committee
PMO	-	Project Management Office
PPDO	-	Provincial Planning and Development Office
PSI	-	Present Servicability Index
PSR	-	Present Serviceability Rating
PTS	-	Philippine Transport Survey
RIA	-	Road Influence Area
RRI	-	Rehabilitation Requirement Index
RRR	-	Rehabilitation Requirement Rating
RDC	-	Regional Development Council
RHU	-	Rural Health Unit
ROW	-	Right-of-way
SBST	-	Single Bituminous Surface Treatment
SN	-	Structure Number
VLF	-	Vehicle Load Factor

## FINDINGS AND RECOMMENDATIONS



# FINDINGS AND RECOMMENDATIONS

## 1. BASIC INFORMATION

### Classification of Provinces and Selection of Study Provinces

Socio-economic development	Adequacy of road	Geography/Topography		
		Flat	Mountainous	Island
Developed	Average	(4) Cavite (3) Pampanga (3) Bulacan (4) Laguna	(1) Benguet (3) Zambales (1) La Union	
Less developed	High	(4) Rizal (4) Batangas	(3) Bataan (2) Nueva Vizcaya (1) Ilocos Norte (12) Lanao del Sur (1) Ilocos Sur (1) Abra (10) Misamis Oriental (8) Southern Leyte (10) Misamis Occidental	(2) Batanes (7) Bohol (4) Romblon (7) Siquijor (10) Camiguin
	Average	(1) Pangasinan (2) Nueva Ecija (2) Tarlac (8) Leyte (5) Albay (6) Iloilo (5) Camarines Sur (6) Capiz (6) Negros Occidental (5) Sorsogon	(10) Bukidnon (2) Cagayan (11) South Cotabato (1) Mountain Province (10) Agusan del Norte (12) Lanao del Norte (2) Ifugao (6) Aklan (5) Camarines Norte (9) Zamboanga del Norte (10) Surigao del Norte (6) Antique	(7) Cebu (5) Catanduanes (4) Marinduque
	Poor	(2) Isabela (1) Davao del Norte (12) Maguindanao (10) Agusan del sur (12) North Cotabato	(4) Occidental Mindoro (3) Quirino (12) Sultan Kudarat (2) Kalinga-Apayao (9) Zamboanga del Sur (11) Davao del Sur (11) Davao Oriental (11) Surigao del Sur (7) Negros Oriental (8) Samar (4) Oriental Mindoro (4) Quezon (8) Northern Samar (8) Eastern Samar (4) Aurora	(9) Sulu (9) Tawi-Tawi (4) Palawan (9) Basilan (5) Masbate

 4 Pilot Provinces (Phase I Study)

 11 Study Provinces (This Study)

Region Number in ( )

Road Length and Cost Proposed for Improvement  
Initial Stage (IRR 15% or more)

Province	MAJOR ROADS		MINOR ROADS		TOTAL	
	Length (km)	Cost (MP)	Length (km)	Cost (MP)	Length (km)	Cost (MP)
La Union	68.0	172.4	40.9	49.8	108.9	222.2
Nueva Vizcaya	22.4	68.5	25.0	24.1	47.4	92.6
Nueva Ecija	214.2	761.1	131.4	209.3	345.6	970.4
Rizal	44.8	94.5	25.8	29.8	70.6	124.3
Occ. Mindoro	42.3	108.8	40.5	46.1	82.8	154.9
Albay	86.6	211.2	157.8	199.0	244.4	410.2
Antique	18.8	85.7	100.6	76.6	119.4	162.3
Samar	30.2	46.4	201.9	144.9	232.1	191.3
Leyte	85.6	163.5	162.5	193.8	248.1	357.3
Misamis Oriental	55.0	211.3	125.9	113.5	180.9	324.8
Davao del Norte	46.1	124.4	118.5	94.7	164.6	219.1
Total	714.0	2,047.8	1,130.8	1,181.6	1,844.8	3,229.4

Road Length and Cost Proposed for Improvement  
Secondary Stage (IRR 7.5% - 15%)

Province	MAJOR ROADS		MINOR ROADS		TOTAL	
	Length (km)	Cost (MP)	Length (km)	Cost (MP)	Length (km)	Cost (MP)
La Union	17.9	11.7	79.8	76.9	97.7	86.6
Nueva Vizcaya	23.1	46.4	96.7	68.7	119.8	115.1
Nueva Ecija	49.4	122.5	61.9	84.7	111.3	207.2
Rizal	-	-	7.4	8.3	7.4	8.3
Occ. Mindoro	29.1	109.5	43.0	51.3	72.1	160.8
Albay	12.1	20.4	69.2	110.5	81.3	130.9
Antique	87.2	220.2	48.3	71.6	135.5	291.8
Samar	86.1	276.3	96.0	98.9	182.1	375.2
Leyte	99.5	266.1	175.2	215.8	274.7	481.9
Misamis Oriental	-	-	148.2	207.7	148.2	207.7
Davao del Norte	128.6	302.6	98.9	114.1	227.5	416.7
Total	533.0	1,375.7	924.6	1,108.5	1,457.6	2,484.2

**Fund Requirement for Rural Road Development Program**  
**Initial Stage (IRR 15% or more)**

(Unit = MP, 1990 Price)

		Construction Cost	Engineering Services	Total
Project Component I	JICA-F/S			
	4-Provinces	950.9		
	11-Provinces	3,229.4		
	Sub-Total	4,180.3		
	Average 1-Province	278.7		
	73-Provinces	20,345.1	2,034.5	22,379.6
Project Component II	Relevant Studies			
	Type A	3,570.0	305.5	3,875.5
	Type B	2,984.1	363.7	3,347.8
	Sub-Total	6,554.1	669.2	7,223.3
Gross Total Project Component I and II		26,899.2	2,703.7	29,602.9

**OVERALL IMPLEMENTATION SCHEDULE OF RURAL ROAD DEVELOPMENT PROGRAM**

	Annual Fund	No. of Provinces Covered	Annual Average Fund per Provinces	Initial Improvement Stage IRR>15%						Secondary Improvement Stage 15>IRR>7.5
				1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	
Locally Funded Projects	P1,853 M	73	P25.4 M	← 6-year Total P11,118 M →						
Foreign Assisted Projects	P3,147 M	73	P43.1 M	← P18,882 M →						
Total	P5,000 M	73	P68.5 M	← P30,000 M →						
Locally Funded Projects										←
Foreign Assisted Projects										←
Total										

## Experimental Pavement

Section	AADT	Pavement Type	Design Subgrade CBR	Design Performance Period (Year)	Thickness (cm)				Length (m)
					Surface	Base	Subbase	Total	
1	150	GR	4	5	15	-	5	20	200
		SBST	4	3	0.5	15	8	23.5	200
		DBST	4	5	1.5	15	9	25.5	200
		BMP	4	7	5	15	5	25	200
2	150	GR	3	5	15	-	8	23	200
		SBST	3	3	0.5	15	12	27.5	200
		DBST	3	5	1.5	15	14	30.5	200
		BMP	3	7	5	15	10	30	200
3	900	DBST	3	5	1.5	15	30	46.5	200
		BMP	3	7	5	15	26	46	200
		AC	8	8	4	12	8	24	200
		AC	8	10	5	12	6	23	200
4	900	DBST	8	5	1.5	15	13	29.5	200
		BMP	5	7	5	15	16	36	200
		AC	3	8	4	15	23	42	200
		AC	3	10	5	15	21	41	200
5	2,100	AC	5	5	5	15	19	39	200
		PCC	5	8	18	-	20	38	200



## 2. RECOMMENDATIONS

- 1) Consistent with the Government's development policy of attaching importance to rehabilitation, improvement and expansion of the feeder and secondary network, it is recommended that the promotion of rural road network development contribute to the national development goals, viz., alleviation of poverty, generation of more productive employment, promotion of equity and social justice, and the attainment of sustainable economic growth.
- 2) In the implementation of the project, the following should be investigated:
  - Strengthening of project institution by organizing a project management office for the project,
  - Introduction of a community participation system,
  - Introduction of a labor-based/equipment-supported construction system,
  - Development of standardized technology,
  - Implementation by administration for small size projects, and
  - Application of sector loan system for foreign assisted projects.
- 3) Regarding design and construction of low-class pavements to be used for the project, the following are recommended:

### On administration,

- Development of standard pavement types in consideration of both monetary and non-monetary factors,
- Establishment of pavement rehabilitation criteria incorporating an appropriate indicator therein, and
- Guidelines for construction of pavement in rainy season.

### On design,

- Provision of guidelines for preparation and/or selection of the inputs required for design,
- *Provision of guidelines for selection of initial and terminal serviceabilities, and*
- Introduction of planned rehabilitation strategy including upgrading of initial pavement type.

### On construction,

- Conformity with design and specification requirements at reasonably estimated cost,
- Establishment of systematic construction schedule supported by equipment schedule, material schedule, manpower schedule and financial schedule, and
- Introduction of various techniques including stabilization methods for subbase and base course and the like.



## INTRODUCTION



# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND OF THE STUDY

The transport system of the Philippines is characterized by the predominance of road transport for intra-island, and coastal shipping for inter-island movements. Railroads play only a marginal role, while domestic aviation which had developed only recently, caters mainly to the upper echelon of passenger traffic. Road transport accounts for about 22 billion ton-kilometers per year or about 60% of total freight movements, and over 53 billion passenger-kilometers per year or 80% of passenger traffic, while inter-island and coastal shipping accounts for nearly 40% of total freight traffic and 8% of passenger traffic. The National Transport Planning Project (NTPP) estimates the rate of increase of passenger traffic at 6.5% per annum (p.a.) for roads, 8.2% p.a. for shipping, 2.9% p.a. for air transport, and a decline of 2.9% p.a. for railways.

As of 1986, the public road network of the Philippines covers a total length of about 162,325 kms, consisting of about 26,230 kms. of national roads which form the main trunkline system; 45,216 kms. of provincial, municipal and city roads; and 90,879 kms. of barangay roads.

In general, national roads carry significant volumes of traffic providing connections between populated urban centers and linking provinces. Provincial roads carry medium to low traffic volumes and constitute the main network within the provinces. City and municipal roads are mainly urban roads, while barangay roads function mostly as penetration feeders, and as a farm-to-market road system of the country.

The development program regarding the national road system of the country has been pushed forward with increased momentum starting in the early 1970's following the completion of the Philippine Transport Survey (PTS). Since then, the program is being actively implemented with technical/financial assistance provided by such external sources as JICA, OECF, ADB, USAID, OPEC and other organizations and donor countries.

With the upsurge in road construction, upgrading and restoration activities in the 1970's and early 1980's, the extent and coverage of the network of primary roads may be considered currently adequate especially in built-up areas, major municipalities and population centers. This is not true for some rural areas where the road network systems are still deemed as being inadequate. The inadequacy of the road network system results in constraining growth and progress in these areas.

The updated highway program has stressed the need of rural road improvement in these areas and has given high priority to such projects. The formulation of systematic implementation programs for rural road improvement, therefore, are in vital need and being vigorously set forward. This has gained increased significance in the light of the Government's current policies geared towards the alleviation of poverty, generation of more productive employment, promotion of equity and social justice, and the attainment of sustainable economic growth.

In line with this policy, the Pilot Study for the Rural Road Network Development Project (hereinafter referred to as "the Phase I Study") was conducted with technical assistance provided by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), which is the official agency responsible for the implementation of technical cooperation programs set up by the Government of Japan. The Pilot study is an initial step in formulating a systematic plan for providing a basic road network with emphasis placed on the development of a rural road network in selected provinces. In order to verify and enlarge the result of the Phase I Study, and to further promote the rural road network development project, the Government of the Republic of the Philippines (hereinafter referred to as GRP) has planned to conduct the Feasibility Study on the Rural Road Network Development Project (hereinafter referred to as "The Study").

GRP through the Department of Public Works and Highways (hereinafter referred to as "DPWH") sought technical assistance from GOJ for the conduct of the Study.

In response to GRP's request, GOJ decided to conduct the Study. JICA organized a team of ten (10) experts to be engaged in the Study. The JICA Study Team, in close collaboration with the DPWH Counterpart Team, commenced work in October 1989 and completed its tasks in October, 1990.

## **1.2 OBJECTIVES OF THE STUDY**

**Objectives of the Study are to:**

- i) Conduct a feasibility study on the development of a rural road network to verify and enlarge the result of the Pilot Study conducted recently by JICA for the Rural Road Network Development Project.**
  - Establish basic technical and administrative procedures and methods for the functional development of a road network for the rural areas of about 10 provinces:**
  - Recommend a system and investment program for the implementation of rural road projects:**
- ii) Investigate the performance of low-class pavements and recommend structural designs for the economical implementation of the above projects.**
- iii) The Study Team shall exercise maximum technology transfer to the Filipino engineers in the course of the Study.**

### **1.3 SCOPE OF THE STUDY**

In order to achieve the objectives mentioned above, the Study which consists of two (2) parts (PART-A and PART-B) was carried out in three (3) main stages. The scope of the work for each stage are as follows:

#### **PART-A: Feasibility Study on the Rural Road Projects**

##### **Stage 1: Selection of Study Provinces**

About ten (10) provinces shall be selected for the Study, taking into consideration the socio-economic characteristics, adequacy of road networks, etc. of provinces assessed under the Phase I Study.

##### **Stage 2: Project Identification and Screening**

On the provinces selected in Stage 1, the road projects shall be identified in consideration of the road network requirements for promoting the development of the rural areas.

##### **Stage 3: Project Evaluation**

For the road projects selected in Stage 2, feasibility studies shall be conducted, which shall include, but not to be limited to, the following:

- Project evaluation
- Verification of the simplified evaluation method
- Development of implementation program

#### **PART-B: Study on Low-Class Pavements**

##### **Stage 1: Preparation of the Study**

The road sections as well as experimental models for pavements to be constructed shall be selected for the Study. Various construction arrangements shall be finalized.

##### **Stage 2: Analysis and Designing**

An engineering study on each variation of the pavements selected in Stage 1 shall be undertaken.



**Stage 3: Experimental Construction and Follow-up Survey**

Experimental construction of pavements with several variations designed in Stage 2 shall be conducted to evaluate the constructibility, material combination, quality control, etc.

Manuals for the follow-up survey to be conducted by DPWH for the above pavements for the following 5 years shall be prepared.

The effectiveness of the structural design recommended in Stage 2 of PART-B shall be verified through the above experimental construction and follow-up survey.

Since major activities for project evaluation in stage 3 of PART-A was completed at the end of June 1990, the damages brought about the earthquake on July 16, 1990 is not reflected in the Report.

The study flow diagram is presented in Figure 1.3-1.

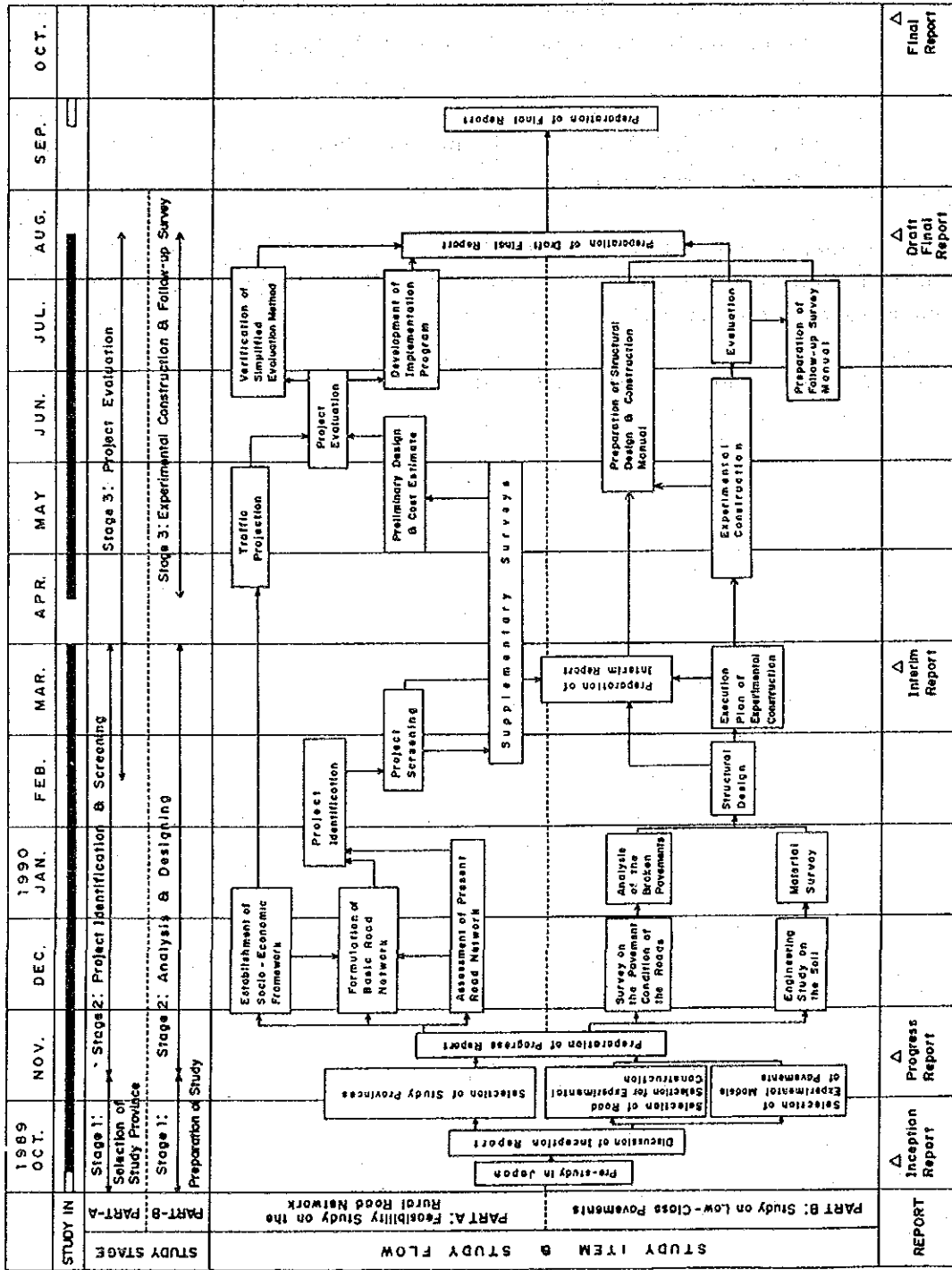


FIGURE 1.3-1 STUDY FLOW DIAGRAM

## 1.4 ORGANIZATION FOR EXECUTING THE STUDY

The study was undertaken jointly by the JICA Study Team and the DPWH Counterpart Team. The Study was conducted under the guidance of the DPWH Steering Committee and JICA Advisory Committee.

The organization chart is shown in Figure 1.4-1.

The members who had participated in the Study are listed below:

### DPWH Steering Committee

Chairman	Teodoro T. Encarnacion
Member	Manuel M. Bonoan
Member	Leonardo Nunez
Member	Francisco N. Pascual
Member	Manuel Mapa
Member	Jesus Espiritu
Member	Jose P. Gloria
Member	Hideo Tsuji (Oct. 1989-July 1990)
Member	Ryoji Hagiwara (July 1990-Oct. 1990)
Member	Kuniaki Nakamura

### DPWH Counterpart Team

Team Leader	Jose P. Gloria
Proj. Coordinator/Highway Planner Highway Engineer, La Union Group	Geronimo Alonzo Tessie Mangaoil Agustin Talay Jr.
Highway Engineer, Nueva Vizcaya Group	Pedro Ocampo Jr. Charisse Dizon
Highway Engineer, Nueva Ecija Group	Nenita Jimenez Ramon Corpuz
Highway Engineer, Rizal Group	Juanito Alamar Lourdes Romero
Highway Engineer, Occidental Mindoro Group	Norberto Gonzalbo Antonio Yaptangco
Highway Engineer, Albay Group	Magdalena Euste Susan Maano
Highway Engineer, Antique Group	Jose Teodorico Real Jr. Ronald Marcelino
Highway Engineer, Samar Group	Ariel Dimaano Gregorio Espinosa
Highway Engineer, Leyte Group	Alexander Fernandez Angelito Cayanan Jr.

Highway Engineer, Misamis Oriental Group	Arturo Flores
	Joselito Montana
Highway Engineer, Davao del Norte Group	Generoso Alconis
	Alberto Suniga
Economist, La Union Group	Josefina Sulit
Economist, Nueva Vizcaya Group	Lilia Naungayan
Economist, Nueva Ecija Group	Encarnita Cubelo
Economist, Rizal Group	Rosemarie del Rosario
Economist, Occidental Mindoro Group	Dolores Manzano
Economist, Albay Group	Ella Dioneda
Economist, Antique Group	Josefina Rafol
Economist, Samar Group	Rebecca Callangan
Economist, Leyte Group	Josephine Gumboc
Economist, Misamis Oriental Group	Gloria Malinit
Economist, Davao del Norte Group	Erwin Almonte
Traffic Engineer	Cesario Vicente
Pavement Engineer	Marietta Velasco
	Celso Tutor
Construction Engineer	Walter Ocampo
	Rolando Santiago
Soils and Materials Engineer	Bienvenido Noco
	Danilo Agustin
	Jonathan Angel

#### JICA Study Team

Team Leader/Regional Planner	Kunihiko Sawano
Deputy Team Leader/Adm. Expert	Tsuneo Bekki
Highway Planner	Mitsuo Hatakeyama
Highway Engineer	Akira Takaku
Highway Engineer	Soemu Oshita
Highway Engineer	Koukichi Terai
Highway Engineer	Sadayuki Miyamoto
Highway Engineer	Takao Mitsuishi
Pavement Expert	Koichi Suzuki
Pavement Engineer	Takao Takahashi

#### JICA Advisory Committee

Chairman	Yoshiharu Tomioka (Oct. 1989-May 1990)
Chairman	Chikahiro Kamiya (May 1990-Oct. 1990)
Member	Mitsuhiro Tsuchiya
Member	Takashi Sakate

JICA Headquarters

JICA Project Officer	Tadashi Shinoura (Oct. 1989-Mar. 1990)
JICA Project Officer	Kazuo Ishii (Apr. 1990-Oct. 1990)
JICA Project Officer	Kazuo Nakagawa (Oct. 1989-Mar. 1990)
JICA Project Officer	Toshio Sugihara (Apr. 1990-Oct. 1990)
JICA Project Officer	Atsushi Matsumoto (Oct. 1989-Mar. 1990)
JICA Project Officer	Masayuki Koike (Apr. 1990-Oct. 1990)

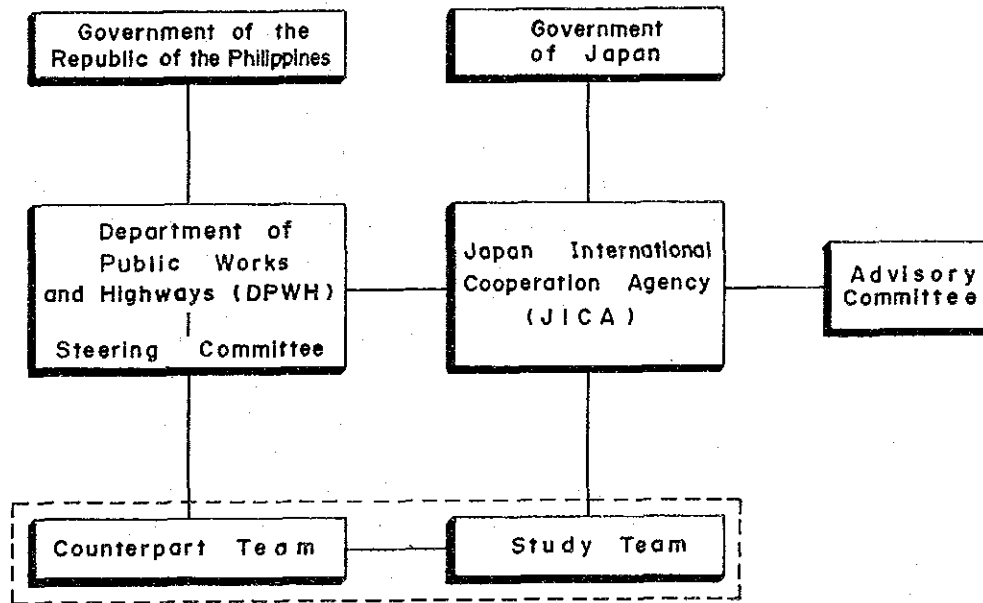


FIGURE 1.4-1 ORGANIZATION CHART

## **1.5 REPORTS**

### **1.5.1 Organization of the Final Report**

The final report is organized as shown below.

#### Common to Part-A and Part-B

- Volume 1 : Executive Summary
- Volume 2 : Main Report
- Volume 3 : Appendix

#### Part-A

- Volume 4 : Project Evaluation in the Province of La Union
- Volume 5 : Project Evaluation in the Province of Nueva Vizcaya
- Volume 6 : Project Evaluation in the Province of Nueva Ecija
- Volume 7 : Project Evaluation in the Province of Rizal
- Volume 8 : Project Evaluation in the Province of Occidental Mindoro
- Volume 9 : Project Evaluation in the Province of Albay
- Volume 10 : Project Evaluation in the Province of Antique
- Volume 11 : Project Evaluation in the Province of Samar
- Volume 12 : Project Evaluation in the Province of Leyte
- Volume 13 : Project Evaluation in the Province of Misamis Oriental
- Volume 14 : Project Evaluation in the Province of Davao del Norte
- Volume 15 : Drawings for Road Projects in the Province of La Union
- Volume 16 : Drawings for Road Projects in the Province of Nueva Vizcaya
- Volume 17 : Drawings for Road Projects in the Province of Nueva Ecija
- Volume 18 : Drawings for Road Projects in the Province of Rizal
- Volume 19 : Drawings for Road Projects in the Province of Occidental Mindoro
- Volume 20 : Drawings for Road Projects in the Province of Albay
- Volume 21 : Drawings for Road Projects in the Province of Antique
- Volume 22 : Drawings for Road Projects in the Province of Samar
- Volume 23 : Drawings for Road Projects in the Province of Leyte
- Volume 24 : Drawings for Road Projects in the Province of Misamis Oriental
- Volume 25 : Drawings for Road Projects in the Province of Davao del Norte
- Volume 26 : Guide for Simplified Project Evaluation

#### Part-B

- Volume 27 : Specifications for Experimental Pavement Construction
- Volume 28 : Drawings for Experimental Pavement
- Volume 29 : Manual for Follow-up Survey of Experimental Pavement
- Volume 30 : Manual for Design and Construction of Low-class Pavement

## **1.5.2 Organization of Main Report**

The main report consists of ten (10) chapters as shown below.

**CHAPTER 1 INTRODUCTION** gives the background, objectives, scope and organization of the study.

Chapters 2 through 6 cover findings obtained in **PART A: FEASIBILITY STUDY ON THE RURAL ROAD PROJECTS.**

**CHAPTER 2 SELECTION OF STUDY PROVINCES** presents data/indices as well as procedures and methodology used for the selection of the study provinces.

**CHAPTER 3 PROJECT IDENTIFICATION AND SCREENING** presents mainly methodologies and criteria for project identification and screening. Details of each Study Province are presented in Volumes 4 through 14.

**CHAPTER 4 PROJECT EVALUATION** presents mainly methodologies for project evaluation. Detailed discussion on each Study Province is presented in Volume 4 through 14 and Volumes 15 through 25.

**CHAPTER 5 SIMPLIFIED EVALUATION METHOD** deals with data analysis for developing a simplified evaluation method. The manual for the proposed simplified evaluation method is presented in Volume 26.

**CHAPTER 6 IMPLEMENTATION PROGRAM** gives implementation strategy, procedure, schedule and project institution.

Chapters 7 through 10 cover findings obtained in **PART B: STUDY ON LOW-CLASS PAVEMENTS.**

**CHAPTER 7 LOW-CLASS PAVEMENT IN THE PHILIPPINES** describes the general status of low-class pavements in the Philippines.

**CHAPTER 8 EXPERIMENTAL PAVEMENT** deals with selection of location and pavement models, engineering surveys, design of selected pavement models, actual construction and evaluation thereof and plan for follow-up survey of which details are presented in volume 29.

**CHAPTER 9 STANDARD STRUCTURAL DESIGN OF LOW-CLASS PAVEMENTS** describes recommended pavement types and their thickness for various traffic levels and subgrade conditions. Detailed discussion is presented in Volume 30.

**CHAPTER 10 RECOMMENDATION ON DESIGN AND CONSTRUCTION OF LOW-CLASS PAVEMENT** gives various recommendations on low-class pavements. Manual for design and construction of low-class pavements is presented in Volume 30.



**PART A  
FEASIBILITY STUDY ON  
THE RURAL ROAD PROJECTS**



## CHAPTER 2

### SELECTION OF STUDY PROVINCES

#### 2.1 BASIC DATA AND INDICATORS BY PROVINCE

##### 2.1.1 Basic Data

The data-base which had been prepared in the Phase I Study was updated. The updated data-base includes the following basic data (\* shows the data updated):

##### 1. Physical and Demographic Data

Data	Year	Data Source
a) Total Land Area in km <sup>2</sup>	-	DPWH Infrastructure Atlas, 1988
b) Arable Area in km <sup>2</sup> (fit for cultivation and other uses with slopes ranging from 0 to 18%)	-	DPWH Infrastructure Atlas, 1988
c) Distance to Metro Manila/ Cebu City/Davao City in kms. (distance from a province to Metro Manila, Cebu City or Davao City, whichever is nearest, adding 100 kms. for a province not connected by land)	-	Study Team
* d) Population	1980	1980 Census of Population and Housing, NCSO
* e) Projected Population	1987	NCSO
* f) Projected Urban/Rural Population	1987	NCSO

## 2. Economic Data

Data	Year	Data Source
* a) Gross Regional Domestic Product at current price in million pesos	1987	NEDA
b) Per Capita Income in pesos per person	1985	1985 Family Income and Expenditures Survey, NCSO
c) Number of Workers by Industrial Sector	1980	1980 Census of Population and Housing, NCSO
* d) Un and Underemployment Rate in %	1988	NCSO

## 3. Agricultural Data

Data	Year	Data Source
a) Total Agricultural Area in hectares	1980	b) + c) below
b) Farm Area in hectares	1980	1986 Philippine Statistical Yearbook, NEDA
c) Unutilized Area (with potential for agricultural use) in hectares	1980	National Land Use Committee, NEDA
d) Crop Area of Palay, Corn, Sugarcane and Coconut in hectares	1980	1980 Census of Agricultural, NCSO
e) Production of Palay (in tons), Corn (in tons), Sugar (in kg.) and Coconut (in 1,000 nuts)	1980	1980 Census of Agricultural, NCSO

#### 4. Social Data

Data	Year	Data Source
* a) Number of Elementary Classrooms	1987	DPWH, Infrastructure Atlas, 1988
* b) Number of Hospital Beds	1987	DPWH, Infrastructure Atlas, 1988
c) Incidence of Poverty in % of the total number of families below the poverty line	1985	Medium - Term Philippine Development Plan (1987-1992) and 1985 Family Income and Expenditure Survey, NCSO

#### 5. Road Data

Data	Year	Data Source
* a) Length of National Roads by Type of Surface	1987	DPWH, Infrastructure Atlas, 1988
* b) Length of Provincial Roads by Type of Surface	1987	DPWH, Infrastructure Atlas, 1988
* c) Length of City Roads by Type of Surface	1987	DPWH, Infrastructure Atlas, 1988
* d) Length of Municipal Roads by Type of Surface	1987	DPWH, Infrastructure Atlas, 1988
* e) Length of Barangay Roads by Type of Surface	1987	DPWH, Infrastructure Atlas, 1988

Basic data are presented in Appendix 2-1.

### 2.1.2 Various Indicators

The indicators developed in the Phase I Study in order to assess the provinces in terms of economic development and the adequacy of road, were recalculated based on the updated basic data by province.

Indicators are listed below with their definitions while the values of indicators are presented in Appendix 2-2:

(1) Physical and Demographic Indicators

i) Topographical Classification

Provinces were classified based on geographic and topographical characteristics by the Study Team into six (6) groups as follows:

- Inland Province with mostly mountainous terrain (abbreviated as "Inl'd. Mt")
- Inland Province with relatively flat plain ("Inl'd. Fl")
- Seaside Province with narrow plain along the sea and mountainous hinterland ("Sea'd. Mt")
- Seaside Province with relatively flat plain ("Sea'd. Fl")
- Province composed of round-shaped island(s) ("Isl'd. Rd")
- Province composed of narrow and long island(s) ("Isl'd. Nr")

ii) Arable Area Ratio

$$\text{Arable Area Ratio (\%)} = \frac{\text{Arable Area (km}^2\text{)}}{\text{Total Area (km}^2\text{)}} \times 100$$

iii) Population Density

$$\text{Population Density (person/km}^2\text{)} = \frac{\text{Population (Persons)}}{\text{Total Area (km}^2\text{)}}$$

iv) Arable Area Population Density

$$\text{Arable Area Population (persons/km}^2\text{)} = \frac{\text{Population (Persons)}}{\text{Arable Area (km}^2\text{)}}$$

v) Urban Population Ratio

$$\text{Urban Population Ratio (\%)} = \frac{\text{Urban Population}}{\text{Total Population}} \times 100$$

vi) **Population Growth Rate**

Average Annual Population Growth Rate in % per annum for the period from 1975 to 1985.

(2) **Economic Indicators**

i) **Per Capita GRDP**

$$\text{Per Capita GRDP (P/person)} = \frac{\text{GRDP (P)}}{\text{Population (persons)}}$$

ii) **Land Productivity**

$$\text{Land Productivity (1000 P/km}^2\text{)} = \frac{\text{GRDP (1000 P)}}{\text{Total Area (km}^2\text{)}}$$

iii) **Per Capita Income**

$$\text{Per Capita Income (P/person)} = \frac{\text{Total Family Income (P)}}{\text{Population (persons)}}$$

iv) **Primary or Secondary or Tertiary Sector Worker Ratio**

Primary (or Secondary or Tertiary) Sector Worker Ratio (%)

$$= \frac{\text{No. of Primary (or Secondary or Tertiary) Sector Workers}}{\text{Total No. of Workers}} \times 100$$

v) **Unemployment Ratio**

$$\text{Unemployment Ratio (\%)} = \frac{\text{No. of Unemployed Persons}}{\text{Total Work Force (persons)}} \times 100$$

vi) **Underemployment Ratio**

$$\text{Underemployment Ratio (\%)} = \frac{\text{No. of Underemployed Persons}}{\text{Total Work Force (persons)}} \times 100$$

vii) **Un and Underemployment Ratio**

$$\text{Un and Underemployment Ratio (\%)} = \text{v) + vi)}$$

(3) Social Indicators

i) Elementary Classroom Ratio

Elementary Classroom Ratio (Classrooms/1,000 persons)

$$= \frac{\text{No. of Elementary Classrooms}}{\text{Population (1000 persons)}}$$

ii) Hospital Bed Ratio

$$\text{Hospital Bed Ratio (Beds/1000 persons)} = \frac{\text{No. of Hospital Beds}}{\text{Population (100 persons)}}$$

iii) Social Facility Ratio

$$\text{Social Facility Ratio} = \frac{1}{2} \left[ \frac{\text{Elementary Classroom Ratio of a Province}}{\text{National Average}} + \frac{\text{Hospital Bed Ratio of a Province}}{\text{National Average}} \right]$$

iv) Incidence of Poverty

Incidence of Poverty (%)

$$= \frac{\text{No. of Families Below the Poverty Line}}{\text{Total No. of Families}} \times 100$$

The poverty line is defined as the monthly income required to satisfy 100% of the nutritional requirements and other needs of a family of six (6). According to the Interagency Working Group on Poverty Determination, NEDA, FNRI and NCSO, the poverty lines in 1985 were as follows:

Philippines	2,382 P
N C R	3,282
Region I	2,374
II	2,194
III	2,550
IV	2,471
V	2,148
VI	2,449
VII	1,982
VIII	2,016
IX	2,118
X	2,262
XI	2,388
XII	2,233



(4) Agricultural Indicators

i) Major Crop

The major crops of provinces are defined by the Study Team as being four (4): palay, corn, sugarcane and coconut, which have the highest share in the area harvested.

ii) Yield (or Land Productivity)

$$\text{Yield} = \frac{\text{Production}}{\text{Area Harvested}}$$

Yield for palay : ton/ha  
corn : ton/ha  
sugarcane : kg/ha  
coconut : nuts/tree

iii) Unutilized Agricultural Area Ratio

Unutilized Agricultural Area Ratio (%)

$$= \frac{\text{Unutilized Area (ha)}}{\text{Total Agricultural Area (ha)}} \times 100$$

iv) Accessibility to Metro Manila/Cebu City/Davao City

$$\text{Accessibility} = \frac{l_m}{1 + l_m}$$

where  $l$  = Distance from a province to Metro Manila, Cebu City or Davao City, whichever is nearest, adding 100 km for a province not connected by land.

$l_m$  = Average distance

v) Agricultural Productivity I

Agricultural Productivity I is defined by the Study Team as follows:

$$\text{Agricultural Productivity I} = \sum_{i=1}^4 \left( \alpha_i \times \frac{Y_i}{Y_{i \max}} \right) \times 100$$

where  $\alpha_i$  =  $\frac{\text{Area Harvested of Crop } i}{\text{Total Area Harvested of 4 Crops}}$

$Y_i$  = Yield of crop  $i$

$Y_{i\max}$  = Present maximum yield level of crop in the Philippines

For palay,  $Y_1$ , max=3.3 ton/ha  
 corn,  $Y_2$ , max=2.3 ton/ha  
 sugarcane,  $Y_3$ , max=73.0 kg/ha  
 coconut,  $Y_4$ , max=65 nuts/tree

vi) Agricultural Productivity II

Agricultural Productivity II is defined by the Study Team as follows:

Agricultural Productivity II

$$= \text{Agricultural Productivity I} \times \frac{A_1}{A_1 + \alpha \cdot A_2}$$

where  $A_1$  = Farm area in hectares

$A_2$  = Unutilized area in hectares

$\alpha$  = Accessibility to Metro Manila, Cebu City or Davao City

(5) Road Development Indicators

i) Road Density Per Unit Area (Road Density I)

$$\text{Road Density I} = \frac{L}{A}, \frac{L}{A_{ar}}, \frac{L'}{A}, \frac{L'}{A_{ar}}, \frac{L''}{A} \text{ or } \frac{L''}{A_{ar}}$$

where:  $L$  = Total physical road length in km

$L'$  = Fair condition road length in km  
 (assumed by the Study Team)  
 $= \alpha \cdot l_{pcc} + \beta \cdot l_{ac} + \gamma \cdot l_{gr} + \delta \cdot l_{et}$

$L''$  = Road length paved with PCC and AC in km  
 $= l_{pcc} + l_{ac}$

$A$  = Total land area

$A_{ar}$  = Arable area

where:  $l_{pcc}, l_{ac}, l_{gr}$  and  $l_{et}$  = Length of PCC, AC, gravel and earth roads, respectively

$\alpha, \beta, \gamma, \delta =$  Ratio of road length in acceptable condition for each surface type (assumed by the Study Team as  $\alpha = 1.0$ ,  $\beta = 0.6$ ,  $\gamma = 0.15$  for barangay roads and 0.30 for other roads, and  $\delta = 0$ )

ii) Road Density Per Unit Area and Population (Road Density II)

$$\text{Road Density II} = \frac{L}{\sqrt{PA}}, \frac{L'}{\sqrt{PA}} \text{ or } \frac{L''}{\sqrt{PA}}$$

where: L, L' and L'' = Same definition as i) above  
P = Population in 1,000  
A = Total land area in km<sup>2</sup>

iii) Road Density Per Unit Area, Population and Per Capita Income (Road Density III)

$$\text{Road Density (III)} = \frac{L}{I\sqrt{PA}}, \frac{L'}{I\sqrt{PA}} \text{ or } \frac{L''}{I\sqrt{PA}}$$

where: L, L' and L'' = Same definition as i) above  
P = Population in 1,000  
A = Total land area  
I = Per capita income in P/person

iv) Fair Condition Road Ratio

$$\text{Fair Condition Road Ratio} = \frac{L'}{L}$$

where: L and L' = Same definition as i) above

## 2.2 CLASSIFICATION OF PROVINCES

The following three (3) factors were considered in the classification of provinces:

- 1) Socio-economic development,
- 2) Adequacy of road, and
- 3) Geographical/Topographical characteristics.

Provinces were classified in different ways using each independent factor or two or three factors combined.

### 2.2.1 Classification According to Socio-economic Development

#### (1) Selection of Indicators

Various indicators related to socio-economic development were taken into consideration in the classification of provinces. They are divided into three (3) groups consisting of 12 indicators as shown in Table 2.2-1.

TABLE 2.2-1 INDICATORS USED IN CLASSIFICATION OF PROVINCES

G R O U P	I N D I C A T O R S
Demographic Characteristics	Arable Area Ratio Population Density Urban Population Ratio Population Growth Rate
Socio-Economic Characteristics	Per Capita GRDP Land Productivity (GRDP/Area) Per Capita Income Un/Underemployment Ratio Social Facility Ratio Incidence of Poverty
Agricultural Productivity	Agricultural Productivity I Agricultural Productivity II

#### (2) Classification Procedures

The Classification Procedures are illustrated in Figure 2.2-1.

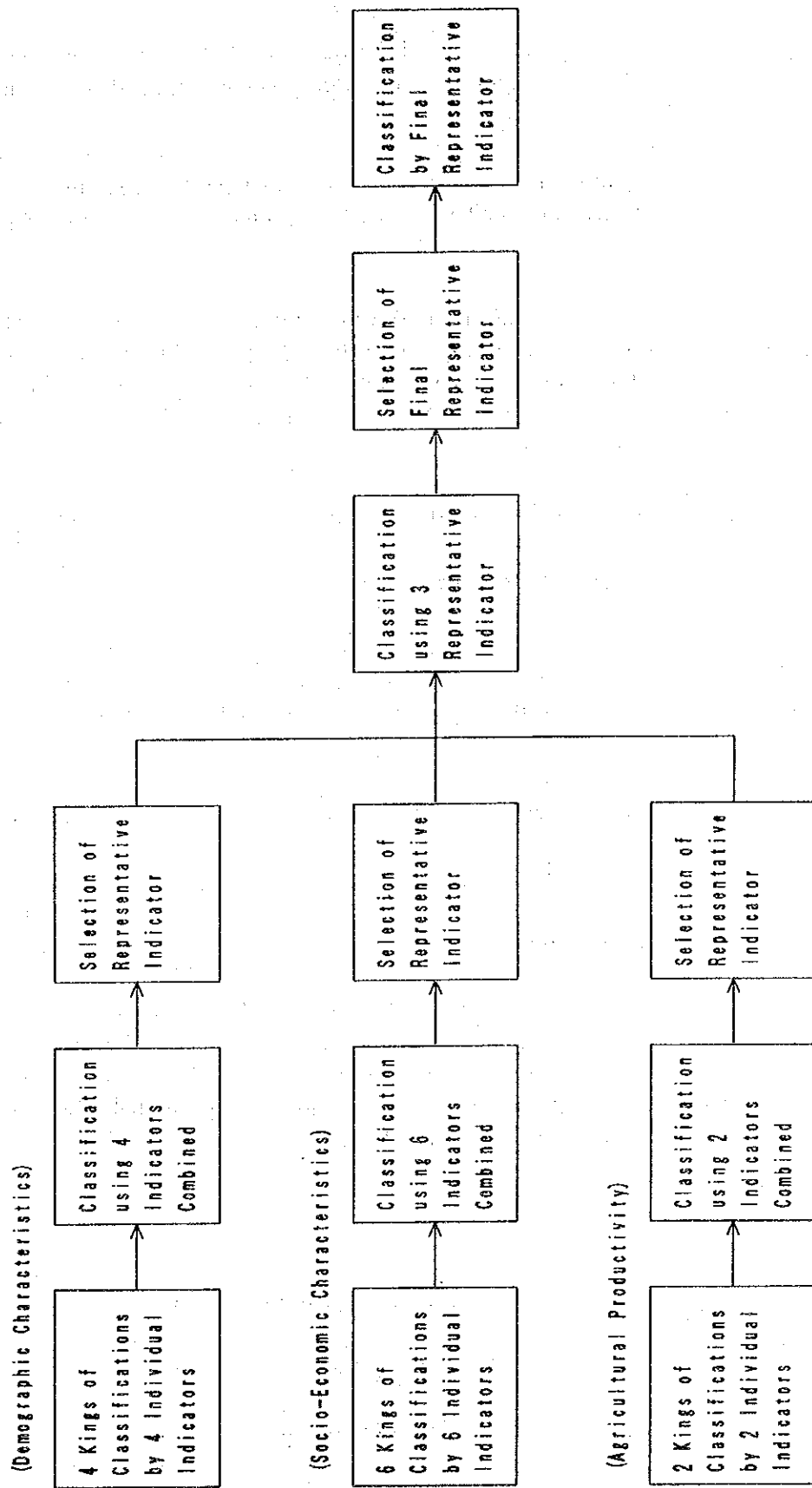


FIGURE 2.2-1 PROCEDURES OF CLASSIFICATION OF PROVINCES

**(3) Representative Indicator of Demographic Characteristics**

Provinces were classified based on each of four (4) indicators: arable area ratio, population density, urban population ratio and population growth rate. Thus, four kinds of classification were made.

Then, a combined value of four indicators (weighted total of four indicators) was calculated for each province, and based on this value, a classification of provinces was made.

The classification by the combined value was compared with the classifications by individual indicators. As a result, the classification by population density was found to be the most similar to and not unacceptably different from the classification by the combined value. Thus, population density was regarded as a representative indicator of demographic characteristics.

The detailed procedures and calculation results are presented in the Phase I Report.

**(4) Representative Indicator of Socio-economic Characteristics**

In the same way as above, incidence of poverty was selected as a representative indicator of socio-economic characteristics including six (6) indicators; per capita GRDP, land productivity, per capita income, un/underemployment ratio, social facility ratio, and incidence of poverty.

**(5) Representative Indicator of Agricultural Productivity**

Agricultural productivity I was selected as a representative indicator.

**(6) Selection of Final Representative Indicator**

A classification of provinces was made according to the combined value of three (3) representative indicators; population density for demographic characteristics, incidence of poverty for socio-economic characteristics and agricultural productivity I for agricultural productivity. The combined value was calculated as a total of three indicators which were standardized as follows:

$$x_i^* = \frac{x_i - \bar{x}_i}{\sigma_i}$$

where:  $x_i^*$  : Standardized value of indicator i

$x_i$  : Value of Indicator i

$\bar{x}_i$  : Mean value of indicator i

$\sigma_i$  : Standard deviation of indicator i

Based on comparison of the classification by the combined value with the classification by individual representative indicators, incidence of poverty was selected as a final representative indicator of the comprehensive provincial characteristics including demographic characteristics, socio-economic characteristics and agricultural productivity.

Selection of representative indicators is summarized in Table 2.2-2.

TABLE 2.2-2 SELECTION OF REPRESENTATIVE INDICATORS

Group	Indicator	Representative Indicator	Final Representative Indicator
Demographic Characteristics	Arable Area Ratio, Population Density, Urban Population Ratio, Population Growth Rate	Population Density	Incidence of Poverty
Socio-economic Characteristics	Per Capita GRDP, Land Productivity, Per Capita Income, Un/underemployment Ratio, Social Facility Ratio, Incidence of Poverty	Incidence of Poverty	
Agricultural Productivity	Agricultural Productivity I, Agricultural Productivity II	Agricultural Productivity I	

It was verified by the principal component analysis that the incidence of poverty is the principal indicator representing the characteristics of provinces.

(7) Classification of Provinces According to Socio-Economic Development

Provinces are arranged in ascending order of the incidence of poverty which is considered as a representative indicator of socio-economic development of provinces (Refer to Appendix 2-3).

## 2.2.2 Classification According to Adequacy of Road

### (1) Selection of Indicator

#### a) Road Length

Three (3) kinds of road length were examined:

L : Total road length

L' : Fair condition road length

L'' : Road length paved with PCC and AC

L and L'' are considered to be inappropriate for the assessment of the adequacy of road. L includes all roads regardless of condition or whether they are functioning or not. L'' does not include gravel surface roads in fair condition, which usually carry light traffic, especially in rural areas. Gravel surface roads can be regarded as an appropriate surface type for rural roads. L' is considered the most appropriate road length to be used for assessment of the adequacy of road. Factors to determine L' are assumed by the Study Team to be as follows:

PCC Pavement : 100% in fair condition

AC Pavement : 60% in fair condition

Gravel Surface : 15% of barangay roads and 30% of remaining roads in fair condition

Earth Surface : 0% (no earth surface road in fair condition)

#### b) Road Density

The indicators representing road density are as follows:

i)  $\frac{L'}{A}$  or  $\frac{L'}{A \cdot r}$

ii)  $\frac{L'}{\sqrt{P \cdot A}}$

iii)  $\frac{L'}{\alpha \cdot I \sqrt{P \cdot A}}$

iv)  $\frac{L'}{L}$



where:  $L'$  : Fair condition road length  
 $A$  : Land area  
 $Aar$  : Arable area  
 $P$  : Population  
 $\alpha$  : Parameter  
 $I$  : Per capita income  
 $L$  : Total length of existing roads

In every indicator, the denominator represents the necessary length of roads or its proportional value. These indicators were examined on their appropriateness in indicating the adequacy of roads and  $L'/\sqrt{P \cdot A}$  was selected as the most appropriate indicator (refer to Chapter 5.2 of the Final Report of the Phase I Study).

(2) Classification of Province According to Adequacy of Road

Provinces are arranged in descending order of the road density,  $L'/\sqrt{P \cdot A}$ , (refer to Appendix 2-3).

(3) Sub-classification of Provinces According to Adequacy of Road by Class of Road

Roads are classified into two (2) classes, primary/secondary roads and feeder roads as follows:

Primary/Secondary Roads : National, provincial and city roads

Feeder Roads : Municipal and Barangay Roads

To examine the adequacy of roads by class, the road density,  $L'/\sqrt{P \cdot A}$  for each class of roads was computed and plotted. Provinces were classified into five (5) categories according to the road density by class of roads.

Code	Primary/Secondary Roads	Feeder Roads
LL	Relatively good	Relatively good
LS	Relatively good	Relatively good
MM	Average	Average
SL	Relatively poor	Relatively good
SS	Relatively poor	Relatively poor

The provinces as classified under each category by this classification are shown in Appendix 2-3.

### 2.2.3 Classification According to Geographical/Topographical Characteristics

Generally, the formation of a road network varies depending on geographical/topographical characteristics.

From this point of view, provinces were classified into six (6) categories as follows:

- i) Inland Province with mostly mountainous terrain
- ii) Inland Province with relatively flat plain
- iii) Seaside Province with narrow plain along the sea and with mountainous hinterland
- iv) Seaside Province with relatively flat plain
- v) Province composed of round-shaped island(s)
- vi) Province composed of narrow and long island(s)

The provinces as classified under each category by this classification are shown in Appendix 2-3

### 2.2.4 Summary of Classifications by Individual Factors

Table 2.2-3 summarizes the classification of provinces by individual factors.

- Socio-economic development (represented by incidence of poverty)

A	: most developed	14 provinces
B	: second	15 provinces
C	: third	15 provinces
D	: fourth	15 provinces
E	: least	14 provinces

- Adequacy of Road (represented by road density,  $L'/\sqrt{P \cdot A}$ )

All Roads:

A	: higher	14 provinces
B	: second	15 provinces
C	: third	15 provinces
D	: fourth	15 provinces
E	: lowest	14 provinces

By Class of Roads:

	<u>Primary/Secondary Roads</u>	<u>Feeder Roads</u>
LL	: relatively good	relatively good
LS	: relatively good	relatively poor
MM	: average	average
SL	: relatively poor	relatively good
SS	: relatively poor	relatively poor

- Geographical/Topographical Characteristics

Inl'd. Mt	: inland mountainous
Inl'd. F1	: inland, flat
Sea'd. Mt	: seaside, mountainous
Sea'd. F1	: seaside, flat
Isl'd. Rd	: island, round
Isl'd. Nr	: island, narrow

TABLE 2.2-3 SUMMARY OF CLASSIFICATIONS BY INDIVIDUAL FACTORS

	Incidence of Poverty (X)		Road Density $L^2/A^2/PA$					Topographical Classification
	Value	Rank	Total		by Class of Road			
			Value	Rank	Value (Primary/Secondary)	Value (Feeder)	Rank	
All Philippines	59.3	B	.322	D	.185	.136	NM	
NCR	44.1	A	.921	A	.710	.211	LL	Sea'd-FI
Region I	52.3	A	.453	B	.243	.210	LL	
Abra	66.6	C	.460	B	.191	.278	SL	Isl'd-NI
Benguet	38.1	A	.485	B	.354	.131	LS	Isl'd-NI
Ilocos Norte	64.6	D	.647	A	.335	.312	LL	Sea'd-NI
Ilocos Sur	62.4	B	.527	A	.204	.323	SL	Sea'd-NI
La Union	42.8	A	.435	B	.278	.157	LS	Sea'd-NI
Mountain Province	57.1	B	.404	B	.344	.060	LS	Isl'd-NI
Pangasinan	63.7	B	.425	B	.214	.210	SL	Sea'd-FI
Region II	54.6	D	.313	D	.168	.145	SS	
Balabac	74.2	D	1.304	A	.652	.652	LL	Isl'd-Rd
Cagayan	55.0	B	.331	D	.191	.140	NM	Sea'd-FI
Iligan	66.3	C	.370	C	.216	.155	NM	Isl'd-NI
Isabela	51.7	A	.260	D	.138	.142	SS	Isl'd-FI
Kalinga-Apayao	60.5	B	.312	E	.134	.088	SS	Isl'd-NI
Nueva Vizcaya	52.4	A	.481	D	.224	.257	LL	Isl'd-NI
Quirino	53.7	B	.306	D	.203	.103	SS	Isl'd-NI
Region III	44.4	A	.394	B	.227	.167	NM	
Davao	47.2	A	.564	A	.420	.144	LS	Sea'd-NI
Bulacan	36.5	A	.497	A	.230	.267	LL	Sea'd-FI
Nueva Ecija	55.1	B	.359	C	.215	.144	NM	Isl'd-FI
Pampanga	36.5	A	.394	B	.233	.162	NM	Sea'd-FI
Tarlac	56.2	B	.420	B	.223	.197	NM	Isl'd-FI
Zambales	38.3	A	.291	D	.191	.101	SS	Sea'd-NI
Region IV	55.9	B	.396	D	.180	.116	NM	
Aurora	82.0	E	.327	E	.162	.075	SS	Sea'd-NI
Batangas	52.4	A	.525	A	.282	.244	LL	Sea'd-FI
Cavite	31.4	A	.509	A	.357	.152	LS	Sea'd-FI
Laguna	38.8	A	.469	B	.282	.181	LL	Sea'd-FI
Narinduque	82.5	E	.452	B	.320	.132	LS	Isl'd-Rd
Occidental Mindoro	51.6	A	.284	D	.158	.126	SS	Sea'd-NI
Oriental Mindoro	70.5	D	.263	D	.225	.039	LS	Sea'd-NI
Palawan	72.0	D	.314	E	.126	.080	SS	Isl'd-Nr
Quezon	72.5	D	.213	E	.144	.069	SS	Sea'd-NI
Rizal	49.7	A	.479	D	.207	.272	SL	Sea'd-FI
Romblon	63.0	E	.585	A	.279	.306	LL	Isl'd-NI
Region V	73.2	D	.321	D	.209	.112	SS	
Albay	68.8	D	.385	B	.259	.126	NM	Sea'd-FI
Camarines Norte	69.6	D	.328	C	.232	.106	LS	Sea'd-NI
Camarines Sur	71.5	D	.375	C	.228	.147	NM	Sea'd-FI
Calabugan	72.1	D	.378	C	.263	.115	LS	Isl'd-Rd
Nasbate	78.9	E	.156	E	.096	.059	SS	Isl'd-Nr
Sorsogon	79.5	E	.340	C	.239	.101	LS	Sea'd-FI
Region VI	73.1	D	.371	C	.214	.157	NM	
Aklan	68.2	C	.364	C	.202	.163	NM	Sea'd-NI
Antique	80.1	E	.324	D	.169	.165	SL	Sea'd-NI
Capiz	74.0	D	.349	C	.211	.137	NM	Sea'd-FI
Iloilo	69.4	D	.422	B	.249	.174	NM	Sea'd-FI
Negros Occidental	76.1	E	.356	C	.206	.151	NM	Sea'd-FI
Region VII	68.8	D	.355	C	.209	.148	NM	
Bohol	74.8	E	.526	A	.281	.255	LL	Isl'd-Rd
Cebu	66.2	C	.323	D	.209	.124	NM	Isl'd-Nr
Negros Oriental	68.5	C	.247	E	.144	.103	SS	Sea'd-NI
Siquijor	86.9	E	.665	A	.542	.122	LS	Isl'd-NI
Region VIII	70.4	D	.313	D	.193	.120	NM	
Leyte	68.0	C	.386	B	.230	.147	NM	Sea'd-FI
Southern Leyte	69.3	D	.588	A	.408	.182	LL	Sea'd-NI
Eastern Samar	76.6	E	.286	D	.111	.176	SL	Sea'd-NI
Northern Samar	74.9	E	.222	E	.141	.082	SS	Sea'd-NI
Samar	69.6	D	.180	E	.136	.046	SS	Sea'd-NI
Region IX	66.3	C	.281	D	.147	.134	SS	
Basilan	78.4	E	.239	E	.125	.114	SS	Isl'd-Rd
Sulu	65.0	C	.258	D	.168	.090	SS	Isl'd-Rd
Tawi-Tawi	66.0	C	.141	E	.085	.056	SS	Isl'd-Nr
Zamboanga del Norte	70.6	D	.343	C	.182	.161	NM	Sea'd-NI
Zamboanga del Sur	60.9	B	.282	D	.137	.146	SS	Sea'd-NI
Region X	66.2	C	.361	C	.204	.157	NM	
Agusan del Norte	64.1	C	.357	C	.239	.117	NM	Sea'd-NI
Agusan del Sur	68.7	C	.239	E	.155	.083	SS	Isl'd-FI
Bukidnon	81.6	A	.264	C	.175	.189	NM	Isl'd-NI
Camiguin	88.3	E	.753	A	.437	.315	LL	Isl'd-NI
Hinablan Occidental	78.4	R	.476	B	.268	.207	NM	Sea'd-NI
Misamis Oriental	68.3	C	.491	A	.268	.224	LL	Sea'd-NI
Surigao del Norte	71.6	D	.378	C	.231	.148	NM	Sea'd-NI
Region XI	61.7	D	.296	D	.154	.142	SS	
Davao del Norte	59.9	B	.294	D	.171	.120	SS	Sea'd-FI
Davao del Sur	62.5	B	.298	D	.149	.149	SS	Sea'd-NI
Davao Oriental	60.8	C	.217	E	.159	.058	SS	Sea'd-NI
South Cotabato	57.1	B	.380	C	.160	.223	SL	Sea'd-NI
Surigao del Sur	67.7	C	.253	D	.139	.115	SS	Sea'd-NI
Region XII	65.2	C	.293	D	.131	.162	SL	
Lanao del Norte	65.3	C	.336	C	.171	.164	SL	Sea'd-NI
Lanao del Sur	66.0	D	.538	A	.132	.405	SL	Sea'd-NI
Maguindanao	68.4	C	.300	E	.102	.098	SS	Sea'd-FI
North Cotabato	74.3	D	.218	E	.128	.090	SS	Isl'd-FI
Sultan Kudarat	54.8	D	.262	D	.136	.126	SS	Sea'd-NI

### 2.2.5 Combined Classification I According to Socio-economic Development and Adequacy of Road

Incidence of poverty as representative of socio-economic development vs. road density ( $L'/\sqrt{P \cdot A}$ ) as representative of adequacy of road are plotted in Figure 2.2-2. Based on this figure, provinces were classified into four (4) groups as shown in Table 2.2-4. This classification is referred to as "Combined Classification I".

		Adequacy of Road (represented by road density, $L' / \sqrt{P \cdot A}$ )		
		Bad	Average	Good
Socio-Economic Development (represented by incidence of poverty)	Developed	-	AD	-
	Less Developed	BL	AL	GL

BL was further sub-classified into BL-1 and BL-2 according to incidence of poverty. Likewise, AL and GL were sub-classified into AL-1 and AL-2, and GL-1 and GL-2.

The provinces belonging to each group are listed in Table 2.2-5.

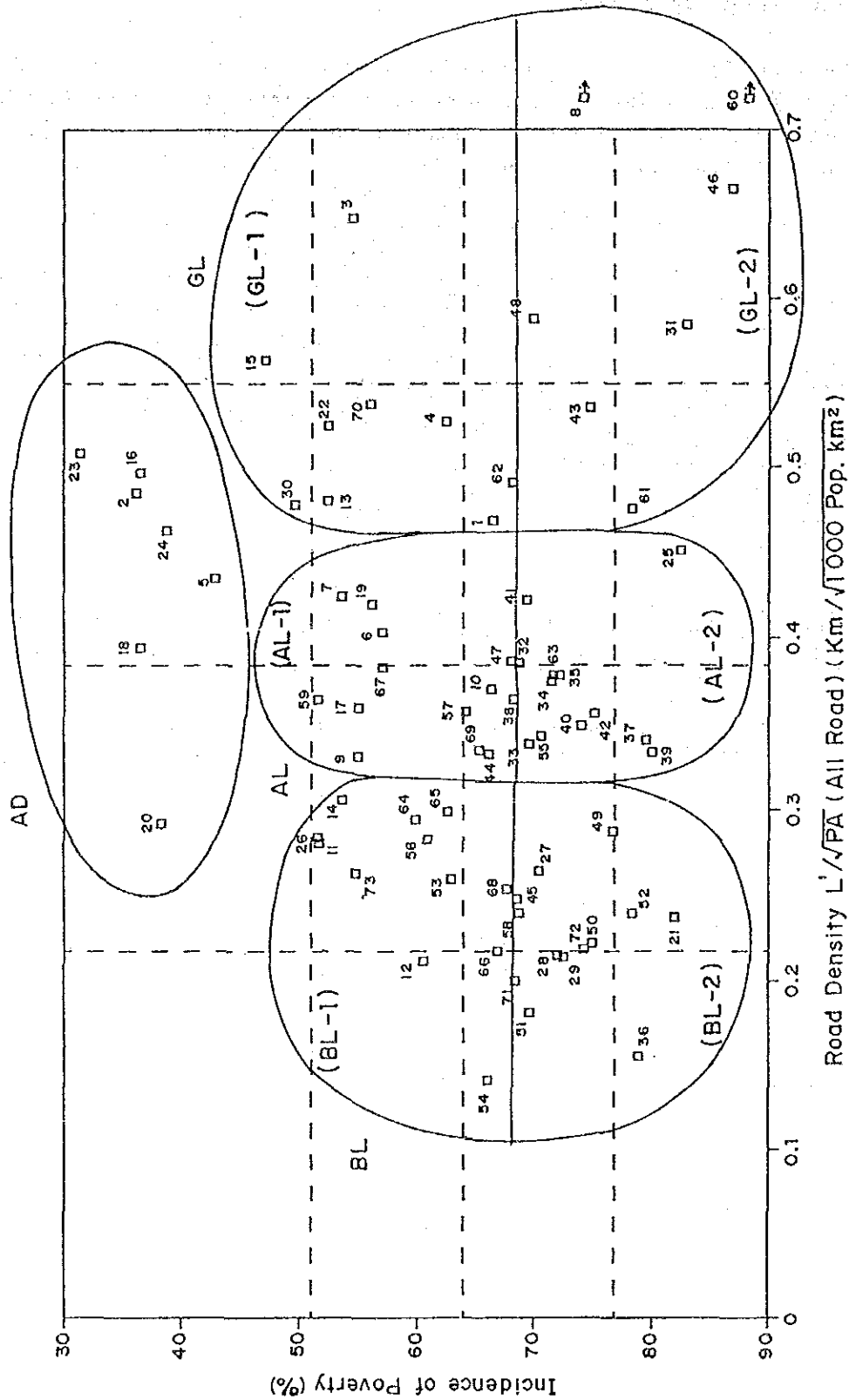


FIGURE 2.2-2 INCIDENCE OF POVERTY V.S. ROAD DENSITY  $L'/\sqrt{PA}$

**TABLE 2.2-5 COMBINED CLASSIFICATION I**  
 (Classification of Provinces According to Socio-Economic Development and Adequacy of Road)

		Adequacy of Road (Represented by Road Density, $L/\sqrt{PA}$ )		
		bad	average	good
Socio-economic Development (Represented by incidence of Poverty)	Developed	-	(AD)  (4) Cavite 23 (1) Benguet 2 (3) Pampanga 18 (3) Bulacan 16 (3) Zambales 20 (4) Laguna 24 (1) La Union 5	-
	Less Developed	(BL)  (4) Occidental Mindoro 26 (2) Isabela 11 (2) Quirino 14 (12) Sultan Kudarat 73 (11) Davao del Norte 64 (2) Kalinga-Apayao 12 (9) Zamboanga del Sur 56 (11) Davao del Sur 65 (9) Sulu 53 (9) Tawi-Tawi 54 (11) Davao Oriental 66 (11) Surigao del Sur 68  (12) Maguindanao 71 (7) Negros Oriental 45 (10) Agusan del Sur 58 (8) Samar 51 (4) Oriental Mindoro 27 (4) Palawan 28 (4) Quezon 29 (12) North Cotabato 72 (8) Northern Samar 50 (8) Eastern Samar 49 (9) Basilan 52 (5) Masbate 36 (4) Aurora 21	(AL)  (10) Bukidnon 59 (1) Pangasinan 7 (2) Cagayan 9 (3) Nueva Ecija 17 (3) Tarlac 19 (11) South Cotabato 67 (1) Mountain Province 6 (10) Agusan del Norte 57 (12) Lanao del Norte 69 (7) Cebu 44 (2) Ifugao 10 (8) Leyte 47 (6) Atlan 38  (5) Albay 32 (6) Iloilo 41 (5) Camarines Norte 33 (9) Zamboanga del Norte 55 (5) Camarines Sur 34 (10) Surigao del Norte 63 (5) Catanduanes 35 (6) Capiz 40 (6) Negros Occidental 42 (5) Sorsogon 37 (6) Antique 39 (4) Marinduque 25	(GL)  (3) Bataan 15 (4) Rizal 30 (4) Batangas 22 (2) Nueva Vizcaya 13 (1) Ilocos Norte 3 (12) Lanao del Sur 70 (1) Ilocos Sur 4 (1) Abra 1 (10) Misamis Oriental 62  (8) Southern Leyte 48 (2) Batanes 8 (7) Bohol 43 (10) Misamis Occidental 61 (4) Romblon 31 (7) Siquijor 46 (10) Camiguin 60

Note : ( ) : Region Number

Number at the end of province name corresponds to number in Fig. 2.2-2

### **2.2.6 Combined Classification II According to Adequacy of Road and Geographical/Topographical Characteristics**

Table 2.2-6 shows the classification of provinces according to two (2) factors combined: adequacy of road by class of road and geographical/topographical characteristics. This classification is referred to as "Combined Classification II".

### **2.2.7 Combined Classification III According to Socio-Economic Development, Adequacy of Road and Geographical/Topographical Characteristics**

Combined Classification III is the classification of provinces using all three (3) factors: socio-economic development, adequacy of road and geographical/topographical characteristics. Since Combined Classification I is made using the first two factors, Combined Classification III can be made by sub-classifying each category of provinces classified by Combined Classification I, using the last factor, geographical/topographical characteristics.

To prevent the number of categories from becoming too large, categories of geographical/topographical characteristics were combined into three (3):

Flat : inland flat and seaside flat combined

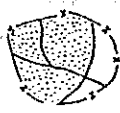
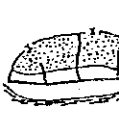

Mountainous : inland mountainous and seaside mountainous combined





Island : island round and island narrow combined

Combined Classification III is shown in Table 2.2-7.



**TABLE 2.2-6 COMBINED CLASSIFICATION II**  
 (Classification of provinces According to Road Adequacy  
 and Geographical/Topographical Characteristics)

Geographical/Topographical Characteristics	Present Formation of Primary Road Network	Primary & Steady Feeder	Adequacy of Road Development by Class of Roads					
			Relatively Good Relatively Good	Relatively Good Relatively Poor	Average Average	Relatively Poor Relatively Good	Relatively Poor Relatively Poor	
In-land Province	<ul style="list-style-type: none"> <li>With mostly mountainous terrain</li> </ul> 	<ul style="list-style-type: none"> <li>Only one or two primary roads penetrate the Province.</li> </ul>	(2) Nueva Vizcaya	(1) Benguet (1) Mt. Province	(2) Surab	(1) Abra	(2) Quirine (2) Malinao Apayao	
					(3) Teriac (3) Nueva Ecija			(2) Isabela (10) Apoan del Sur (12) North Cotabate
Sea-side Province	<ul style="list-style-type: none"> <li>With narrow plain along the sea and with mountainous hinterland</li> </ul> 	<ul style="list-style-type: none"> <li>More or less, mesh type network formed.</li> </ul>	(1) Ilocos Norte (10) Southern Leyte (10) Misamis Oriental	(1) La Union (3) Batang (4) Oriental Mindoro (5) Comandancia Norte	(5) Atitan (9) Zamboanga (10) Surigao (12) Lanao del Norte (12) Lanao del Sur (10) Misamis Occidental (10) Apoan del Norte (10) Apoan del Sur	(1) Ilocos Sur (6) Antique (10) Eastern Samar (11) South Cotabate (12) Lanao del Norte (12) Lanao del Sur	(3) Zamboanga (4) Aurora (4) Occidental Mindoro (4) Ozamis (7) Magos Oriental (10) Marikina Samar (10) Samar	(19) Zamboanga del Sur (11) Davao Oriental (11) Davao del Sur (11) Davao del Norte (12) Sultan Kudarat
			(3) Bulacan (4) Batangas (4) Laguna	(4) Cavite (5) Sorsogon	(2) Cagayan (3) Pangasinan (5) Albay (5) Comandancia Sur (6) Manila (6) Capiz (6) Negros Occidental (6) Letran	(1) Pangasinan (4) Rizal	(11) Davao del Norte (12) Maguindanao	
Island Province	<ul style="list-style-type: none"> <li>Round island</li> </ul> 	<ul style="list-style-type: none"> <li>Circumferential road along the coast plus cross-island roads</li> </ul>	(2) Batangas (4) Marikina (7) Bahay (10) Campanin	(4) Marikina (3) Comandancia (7) Siquil			(19) Sulu (9) Basilan	

Legend:  
 Provincial Boundary  
 Mountainous Area  
 Primary Road  
 Secondary Road

**TABLE 2.2-7 COMBINED CLASSIFICATION III**  
**(Classification of Provinces According to Socio-Economic Development, Adequacy of Road and Geographical/Topographical Characteristics)**

Classification by Socio-Economic Development and Adequacy of Road	Sub-Classification by Topography	Provinces
Economically developed and average level in road development (1)	Flat (1-F)	(4) Cavite (3) Pampanga (3) Bulacan (4) Laguna
	Mountainous (1-M)	(1) Benguet (3) Zambales (1) La Union
Economically Less developed, but high level in road development (2)	Flat (2-F)	(4) Rizal (4) Batangas
	Mountainous (2-M)	(3) Bataan (2) Nueva Vizcaya (1) Ilocos Norte (12) Lanao del Sur (1) Ilocos Sur (1) Abra (10) Misamis Oriental (8) Southern Leyte (10) Misamis Occidental
	Island (2-I)	(2) Batanes (7) Bohol (4) Romblon (7) Siquijor (10) Camiguin
Economically Less developed, and average level in road development (3)	Flat (3-F)	(1) Pangasinan (2) Nueva Ecija (2) Tarlac (8) Leyte (5) Albay (6) Iloilo (5) Camarines Sur (6) Capiz (6) Negros Occidental (5) Sorsogon
	Mountainous (3-M)	(10) Bukidnon (2) Cagayan (11) South Cotabato (1) Mountain Province (10) Agusan del Norte (12) Lando del Norte (2) Ifugao (6) Aklan (5) Camarines Norte (9) Zamboanga del Norte (10) Surigao del Norte (6) Antique
	Island (3-I)	(7) Cebu (5) Catanduanes (4) Marinduque
Economically less developed, and poor level in road development (4)	Flat (4-F)	(2) Isabela (11) Davao del Norte (12) Maguindanao (10) Agusan del Sur (12) North Cotabato
	Mountainous (3-M)	(4) Occidental Mindoro (3) Quirino (12) Sultan Kudarat (2) Kalinga-Apayao (9) Zamboanga del Sur (11) Davao del Sur (11) Davao Oriental (11) Surigao del Sur (7) Negros Oriental (8) Samar (4) Oriental Mindoro (4) Quezon (8) Northern Samar (8) Eastern Samar (4) Aurora
	Island (4-I)	(9) Sulu (9) Tawi-Tawi (4) Palawan (9) Basilan (5) Masbate

## **2.3 PILOT PROVINCES SELECTED IN THE PHASE I STUDY**

The Pilot Provinces were selected in accordance with the following criteria:

- One province should be selected from each group of provinces classified by the Combined Classification I.
- Pilot Provinces should cover four (4) categories out of six (6) of the geographical/topographic characteristics.
- Pilot Provinces should be widely distributed over the country, choosing at least one (1) each from Luzon, Visayas and Mindanao.

The following four (4) provinces were selected as Pilot Provinces in the Phase I Study.

- Cavite
- Masbate
- Bohol
- Agusan del Norte

## **2.4 SELECTION OF STUDY PROVINCES**

### **2.4.1 Selection Procedure of Study Provinces**

There are two major factors to be considered in selecting Study Provinces in this Study.

- i) To select priority provinces where rural road projects to be recommended by this Study are due for implementation so that results of the study can be fully utilized.
- ii) To select provinces which represent a certain group of provinces so that the results of the Phase I Study can be verified and enlarged, particularly on the following issues:
  - To develop a more reliable and practical, simplified project evaluation method which would be applicable to all provinces.
  - To estimate more precise nationwide investment requirements for Rural Road Network Development and prepare a National Level Investment Program.

It should be noted that priority provinces can not be simply selected in this Study, therefore, the second factor must be fully taken into consideration when selecting Study Provinces.

The procedure for selecting Study Provinces is shown in Figure 2.4-1.

#### Step 1: Classification of Provinces

Provinces are classified into 8 to 12 categories based on the socio-economic characteristics, adequacy of roads and other indices (see Section 2.2 of this report).

#### Step 2: Selection of Candidate Provinces

Provinces are pre-screened in accordance with "Candidate Province Selection Criteria" whereby lower priority provinces are excluded from candidate provinces.

#### Step 3: Candidate Provinces By Category

Results of Step 1 and 2 are combined.

#### Step 4: Selection of Study Provinces

Study Provinces are selected from among the candidate provinces in accordance with "Study Province Selection Criteria".

### Step 5: Verification of Distribution of Study Provinces

After verifying proper distribution of the Study Provinces in terms of geographical and categorical distribution, the Study Provinces are finally selected.

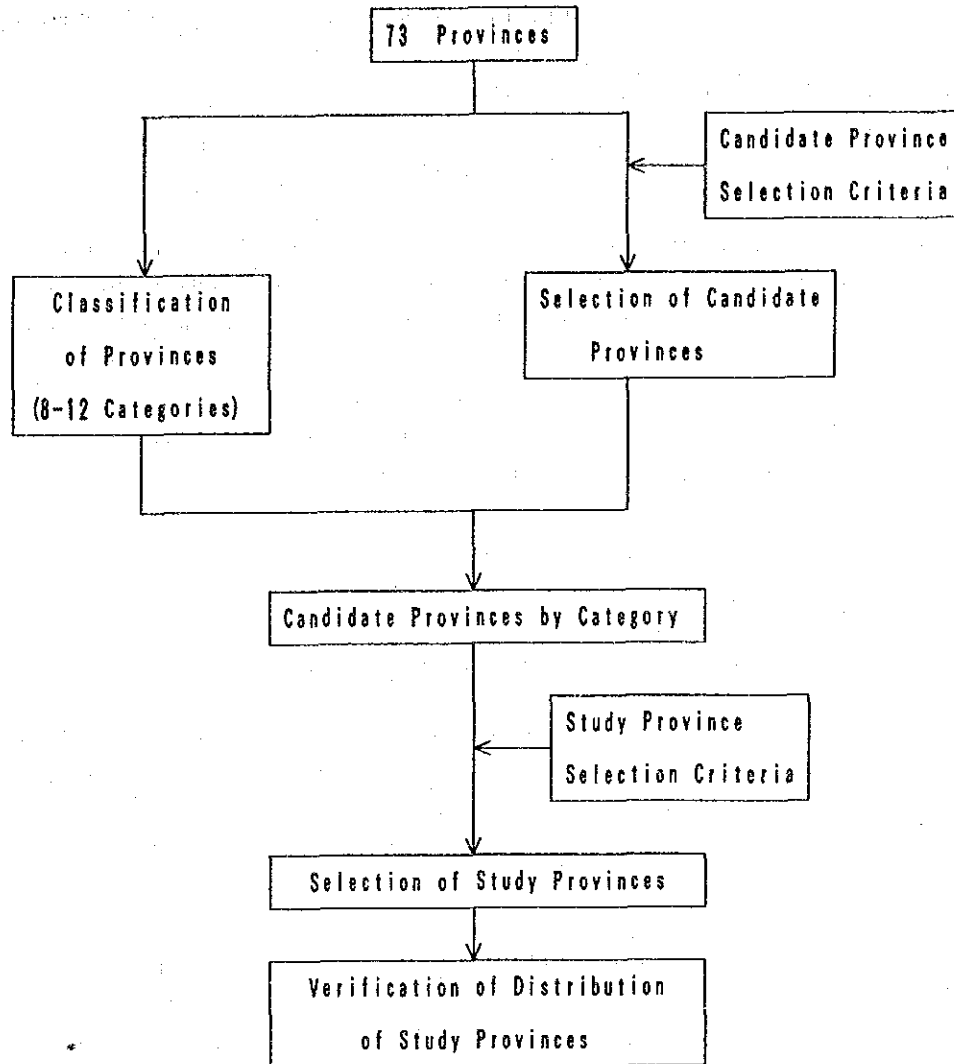


FIGURE 2.4-1 PROCEDURE OF SELECTION OF STUDY PROVINCES.

#### 2.4.2 Selection Criteria

Two (2) kinds of Selection Criteria were developed as shown below.

- "Candidate Province Selection Criteria" for pre-screening provinces.
- "Study Province Selection Criteria" for selecting the Study Provinces from the candidate provinces.

**(1) Candidate Province Selection Criteria**

The following provinces are considered to have lower priority or to be inappropriate for this Study, and were, therefore, excluded from the candidate provinces:

- i) Provinces with more than 150 kms of on-going and/or committed road projects.
- ii) Remote and small island projects.
- iii) Provinces studied in the Phase I Study

Note: On-going/committed road projects are defined as being either Secondary National Roads or Provincial Roads for which construction/improvement, Detailed Engineering Designs and/or Feasibility Studies are on-going and/or committed.

Number of provinces which conform with the aforementioned criteria are as follows: (See Figure 2.4-2. Also refer to Appendix 2-4.)

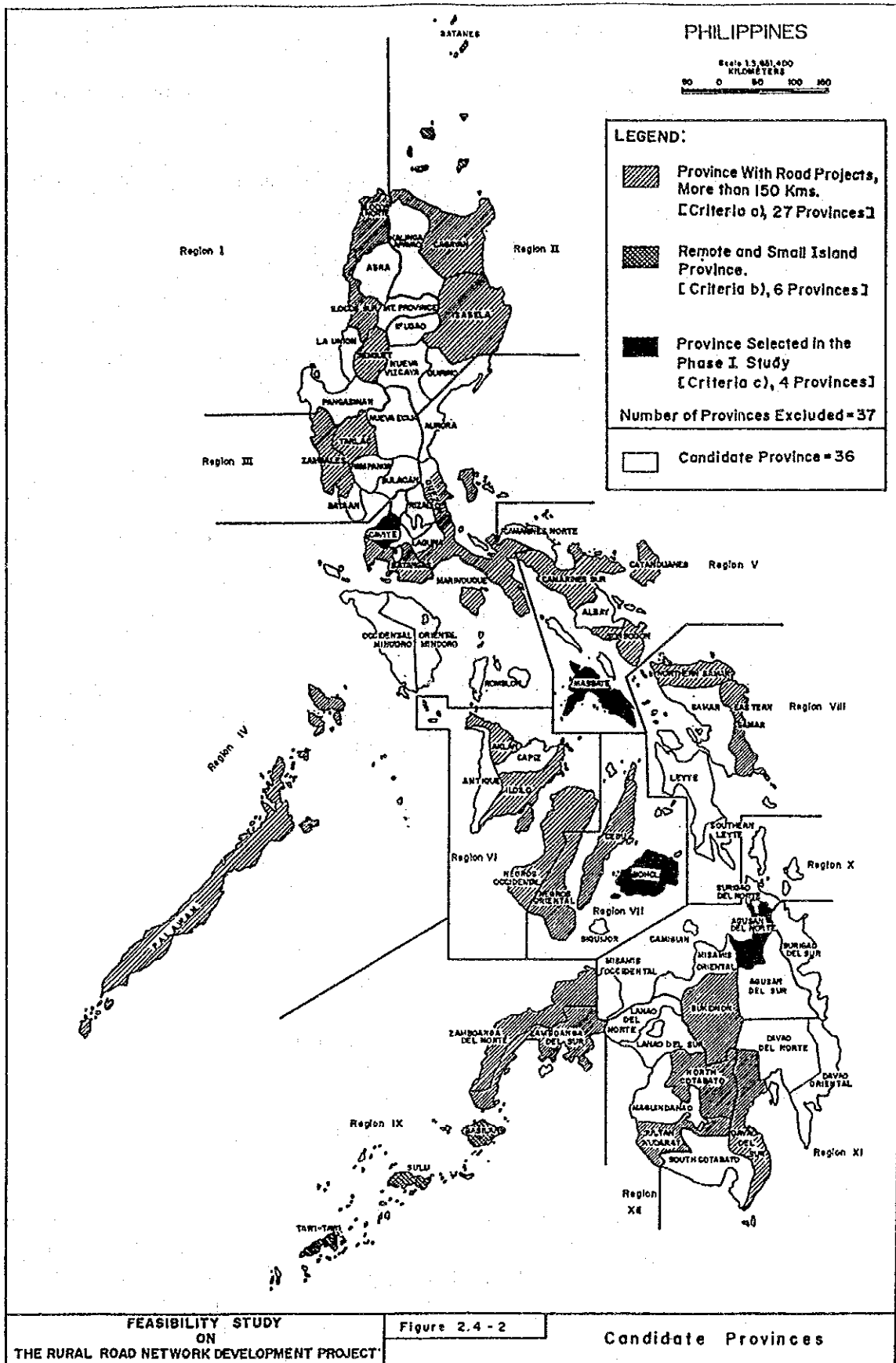
Criteria i) .....	27 provinces
Criteria ii) .....	6 provinces
Criteria iii) .....	4 provinces
<b>T O T A L :</b>	<b>37 provinces</b>

As a result of this pre-screening, 37 provinces were considered to have lower priority or to be inappropriate for this Study. Thus the remaining 36 provinces were selected as "Candidate Provinces".

**(2) Study Province Selection Criteria**

The following criteria are established as "Study Province Selection Criteria":

- i) Provinces where the Improvement of Access Roads to the Pan-Philippine Highway can be studied.
- ii) The Study provinces shall be widely distributed over the country.
- iii) Preferably at least one (1) province should be selected from each category of province classification.
- iv) Provinces without or with less problems regarding peace and order.
- v) To achieve practically the same sampling rate for each category of classification (preferably one Study Province out of 5 provinces).



**FIGURE 2.4-2 CANDIDATE PROVINCES**

### 2.4.3 Selection of Study Provinces

In Section 2.2 of this report, provinces were classified based on various indices and finally three (3) combined classifications were proposed as follows:

- Combined Classification I, of which classification is made by two (2) indices, i.e. Socio-economic Development and Adequacy of Road.
- Combined Classification II, of which classification is made by two (2) indices, i.e. Adequacy of Road and Geographical/Topographical Characteristics.
- Combined Classification III, of which classification is made by three (3) indices, i.e. Socio-economic Development, and Adequacy of Road and Geographical/Topographical Characteristics.

Firstly, Study Provinces were selected from each category of the Combined Classification III which is the most comprehensive classification among the three (3) above. Then, distribution of selected Study Provinces was checked if they also represent categories classified by two (2) other combined classifications I and II.

#### (1) Selection of Study Provinces from Category of the Combined Classification III.

Based on "Study Provinces Selection Criteria", eleven (11) Study Provinces were selected from each category of the Combined Classification III as shown in Table 2.4-1. Selected Study Provinces are also shown in Figure 2.4-3.

Selected Study Provinces are:

La Union	(Region I)
Nueva Vizcaya	(Region II)
Nueva Ecija	(Region III)
Rizal	(Region IV)
Occidental Mindoro	(Region IV)
Albay	(Region V)
Antique	(Region VI)
Samar	(Region VIII)
Leyte	(Region VIII)
Misamis Oriental	(Region X)
Davao del Norte	(Region XI)

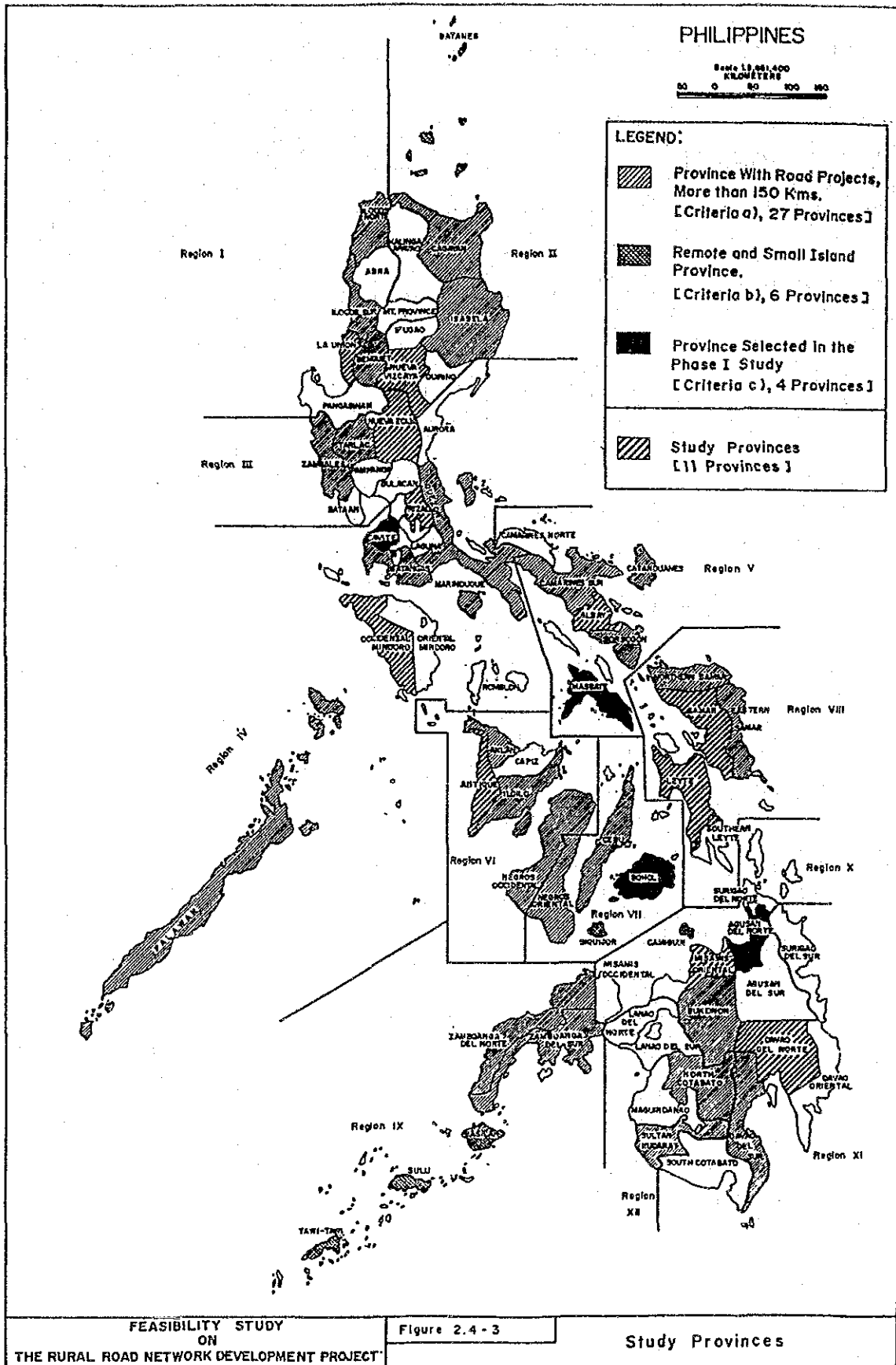
The selected Study Provinces are geographically well distributed over the country as shown in Figure 2.4-3. Six (6) provinces are located along the Pan-Philippine Highway. No province was selected from Category (3-I) because only 3 provinces belong to this category and no candidate province was found therein.



TABLE 2.4-1 COMBINED CLASSIFICATION III AND SELECTED STUDY PROVINCES

Classification by Socio-Economic Development and Adequacy of Road	Sub-Classification by Topography	Provinces	Candidate Provinces	No. of Provinces/Candidate Provinces	No. of Provinces Selected in Phase I Study	No. of Provinces to be Selected in the Study	Selected Study Provinces
Economically developed and average level in road development (1)	Flat (1-2)	(4) Cavite (3) Pangasinan (3) Bulacan (4) Laguna	(3) Pangasinan (3) Bulacan (4) Laguna	4/3	1	-	{(4) Cavite }
	Mountainous (1-3)	(1) Benguet (3) Zambales (1) La Union	(1) La Union	3/1	-	1	(1) La Union
Economically less developed but high level in road development (2)	Flat (2-2)	(4) Rizal (4) Batangas	(4) Rizal	2/1	-	1	(4) Rizal
	Mountainous (2-3)	(3) Batangas (2) Nueva Vizcaya (1) Ilocos Norte (12) Lanao del Sur (1) Abra (12) Ilocos Sur (1) Abra (10) Misamis Oriental (8) Southern Leyte (8) Misamis Occidental	(3) Batangas (2) Nueva Vizcaya (12) Lanao del Sur (1) Abra (10) Misamis Oriental (8) Southern Leyte (8) Misamis Occidental	9/7	-	2	(2) Nueva Vizcaya (10) Misamis Oriental
	Island (2-1)	(2) Batanes (7) Bohol (4) Romblon (7) Siquijor (10) Camiguin	(4) Romblon	5/1	1	-	{(7) Bohol }
Economically less developed, and average level in road development (3)	Flat (3-1)	(1) Pangasinan (2) Nueva Ecija (2) Tarlac (8) Leyte (5) Albay (6) Iloilo (5) Camarines (6) Capiz (6) Negros Occidental (5) Sorsogon	(1) Pangasinan (3) Nueva Ecija (6) Leyte (5) Albay (6) Capiz	10/5	-	3	(3) Nueva Ecija (5) Albay (8) Leyte
	Mountainous (3-3)	(10) Bukidnon (2) Cagayan (11) South Cotabato (1) Mountain Province (10) Agusan del Norte (12) Lanao del Norte (2) Iligan (5) Camarines Norte (10) Surigao del Norte (6) Antique	(11) South Cotabato (1) Mountain Province (12) Lanao del Norte (2) Iligan (5) Camarines Norte (10) Surigao del Norte (6) Antique	12/7	1	1	(6) Antique [(10) Agusan del Norte]
	Island (3-1)	(7) Cebu (5) Catanduanes (4) Marikina		3/0	-	-	-
Economically less developed, and poor level in road development (4)	Flat (4-1)	(2) Isabela (11) Davao del Norte (12) Maguindanao (10) Agusan del Sur (12) Norte Cotabato	(12) Misamis Occidental (10) Agusan del Sur (11) Davao del Norte	5/3	-	1	(11) Davao del Norte
	Mountainous (4-3)	(4) Occidental Mindoro (3) Oquirino (12) Sulu (Kadamat) (2) Kalinga-Apayao (9) Zamboanga del Sur (11) Davao del Sur (11) Davao Oriental (11) Surigao del Sur (11) Negros Oriental (8) Samar (4) Oriental Mindoro (4) Quezon (8) Northern Samar (8) Eastern Samar (4) Aurora	(4) Occidental Mindoro (2) Oquirino (2) Kalinga-Apayao (11) Davao Oriental (11) Surigao del Sur (8) Samar (4) Oriental Mindoro (6) Aurora	15/8	-	2	(8) Samar (4) Occidental Mindoro
	Island (4-1)	(8) Sulu (9) Tawi-Tawi (4) Palawan (8) Basilan (5) Masbato		-	5/8	1	{(5) Masbato}
Classification	Categories	79		36	73/36	4	15

Note: [ ] shows province selected in the Phase I Study



**FIGURE 2.4-3 STUDY PROVINCES**

(2) Verification of Distribution of Study Provinces

a) Combined Classification I

The selected Study Provinces and provinces studied in the Phase I Study were plotted in Figure 2.4-4 and Table 2.4-2. Distribution of these provinces are as follows:

Category	No. of Provinces Belonging to Category	No. of Study Provinces	No. of Provinces Studied in Phase I Study	Total
AD	7	1	1	2
GL-1	9	3	0	3
GL-2	7	0	1	1
AL-1	13	2	1	3
AL-2	12	2	0	2
BL-1	12	2	0	2
BL-2	13	1	1	2
Total	73	11	4	15

Each category is represented by one (1), two (2), or three (3) provinces. Therefore, distribution of Study Province in terms of categorical distribution is considered as being proper.

b) Combined Classification II

Selected Study Provinces and provinces studied in the Phase I study were plotted in Figure 2.4-5, and summarized in Table 2.4-3.

Categories of Combined Classification II, which consist of 22, 13 are covered as Study Provinces. Major categories to which four (4) or more provinces belong are all represented as Study Provinces. It could be said therefore that the Study Provinces are well distributed over the various categories of Combined Classification II.

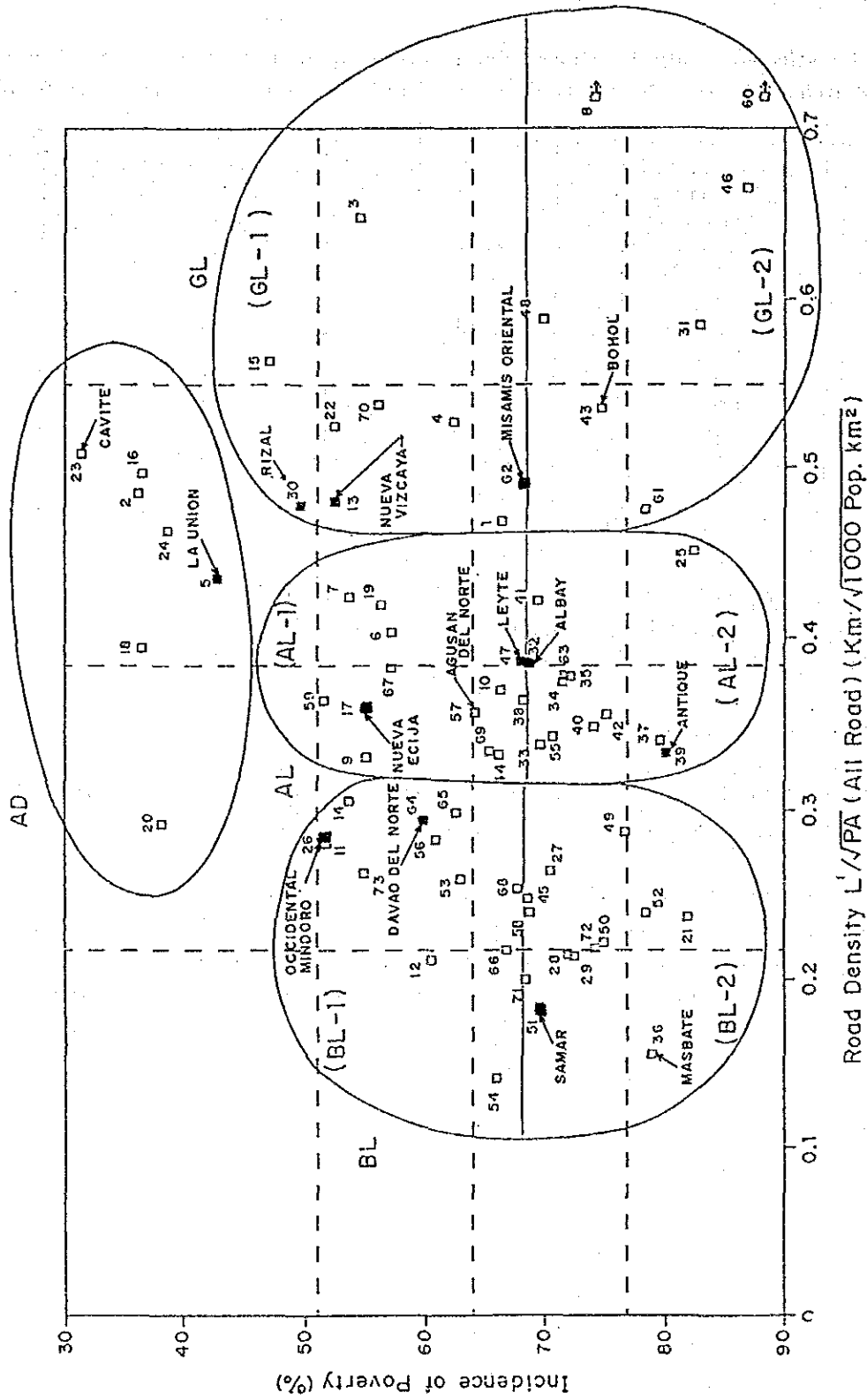


FIGURE 2.4-4 VERIFICATION OF DISTRIBUTION OF STUDY PROVINCES:  
COMBINED CLASSIFICATION I

TABLE 2.4-2. VERIFICATION OF DISTRIBUTION OF STUDY PROVINCES:  
COMBINED CLASSIFICATION I

		Adequacy of Road (Represented by Road Density, L'/√PA)		
		bad	average	good
Socio-economic Development (Represented by incidence of Poverty)	Developed		(AD)	
		-	(4) Cavite 23 (1) Benguet 2 (3) Pampanga 18 (3) Bulacan 16 (3) Zambales 20 (4) Laguna 24 (1) La Union 5	-
	Less Developed	(BL)	(AL)	(GL)
	BL-1	AL-1	GL-1	
	(4) Occidental Mindoro 26 (2) Isabela 11 (2) Quirino 14 (12) Sultan Kudarat 73 (11) Davao del Norte 64 (2) Kalinga-Apayao 12 (9) Zamboanga del Sur 56 (11) Davao del Sur 65 (9) Sulu 53 (9) Tawi-Tawi 54 (11) Davao Oriental 66 (11) Surigao del Sur 68	(10) Bukidnon 59 (1) Pangasinan 7 (2) Cagayan 9 (3) Nueva Ecija 17 (3) Tarlac 19 (11) South Cotabato 67 (1) Mountain Province 6 (10) Agusan del Norte 57 (12) Lanao del Norte 69 (7) Cebu 44 (2) Ifugao 10 (8) Leyte 47 (6) Aklan 38	(3) Bataan 15 (4) Rizal 30 (4) Batangas 22 (2) Nueva Vizcaya 13 (1) Ilocos Norte 3 (12) Lanao del Sur 70 (1) Ilocos Sur 4 (1) Abra 1 (10) Misamis Oriental 62	
	BL-2	AL-2	GL-2	
	(12) Maguindanao 71 (7) Negros Oriental 45 (10) Agusan del Sur 58 (8) Samar 51 (4) Oriental Mindoro 27 (4) Palawan 28 (4) Quezon 29 (12) North Cotabato 72 (8) Northern Samar 50 (8) Eastern Samar 49 (9) Basilan 52 (5) Masbate 36 (4) Aurora 21	(5) Albay 32 (6) Iloilo 41 (5) Camarines Norte 33 (9) Zamboanga del Norte 55 (5) Camarines Sur 34 (10) Surigao del Norte 63 (5) Catanduanes 35 (6) Capiz 40 (6) Negros Occidental 42 (5) Sorsogon 37 (6) Antique 39 (4) Marinduque 25	(8) Southern Leyte 48 (2) Batanes 8 (7) Bohol 43 (10) Misamis Occidental 61 (4) Romblon 31 (7) Siquijor 46 (10) Camiguin 60	

Note : ( ) : Region Number

Number at the end of province name corresponds to number in Fig. 2.2-2

▭ : Study Province

▭ : Province Studied in Phase-I Study

TABLE 2.4-3 DISTRIBUTION OF STUDY PROVINCE: COMBINED CLASSIFICATION II

Geographical/Topographic Characteristics		Adequacy of Road		No. of Provinces Belong to the Category	No. of Study Provinces	No. of Provinces Studied in Phase I Study	Total
		Primary Secondary Road	Feeder Road				
Inland Provinces	Mountainous	Good	Good	1	1	-	1
		Good	Good	2	-	-	-
		Average	Average	2	-	-	-
		Poor	Good	1	-	-	-
		Poor	Poor	2	-	-	-
	Flat	Average	Average	2	1	-	1
		Poor	Poor	3	-	-	-
Sea-side Provinces	Mountainous	Good	Good	3	1	-	1
		Good	Good	4	1	-	1
		Average	Average	5	-	1	1
		Poor	Good	6	1	-	1
		Poor	Poor	12	2	-	2
	Flat	Good	Good	3	-	-	-
		Good	Good	2	-	1	1
		Average	Average	8	2	-	2
		Poor	Good	2	1	-	1
		Poor	Poor	2	1	-	1
Island Provinces	Round Island	Good	Good	4	-	1	1
		Good	Good	3	-	-	-
		Poor	Poor	2	-	-	-
	Narrow/Long Island	Average	Average	1	-	-	-
		Poor	Good	3	-	1	1
Total		22 categories		73	11	4	15

Categories covered by Study Provinces : 13

FIGURE 2.4-5 VERIFICATION OF DISTRIBUTION OF STUDY PROVINCES: COMBINED CLASSIFICATION II

Geographical/Topographical Characteristics	Present Formation of Primary Road Network	Primary & Secondary Feeder	Adequacy of Road Development by Class of Roads					
			Relatively Good	Relatively Poor	Average	Relatively Good	Relatively Poor	Relatively Poor
<ul style="list-style-type: none"> <li>With mostly mountainous terrain</li> </ul>		<ul style="list-style-type: none"> <li>Only one or two primary roads penetrate the Province.</li> </ul>	<p>[2] Bukar-VIQUEDA</p>	<p>111 Benguet (1) Mt. Province</p>	<p>121 Itogon 101 Guejuran</p>	<p>11) Abra</p>	<p>12) Quirino 12) Kalinga Apayao</p>	
<ul style="list-style-type: none"> <li>With vast flat plain</li> </ul>		<ul style="list-style-type: none"> <li>More or less mesh type network formed.</li> </ul>		<p>(3) Tarlac (3) Baguio-LAGID</p>			<p>12) Itebele 10) Agusan del Sur 112) North Cotabato</p>	
<ul style="list-style-type: none"> <li>With narrow plain along the sea and with mountainous hinterland</li> </ul>		<ul style="list-style-type: none"> <li>One primary road along the coast (Comb type network)</li> </ul>	<p>(1) Ilocos Norte (8) Southern Leyte (10) Marikina (10) Marikina Oriental</p>	<p>(1) La Union (3) Batangas (4) Oriental Mindoro (5) Cometas Norte</p>	<p>16) Ateneo 19) Zamboanga del Norte 10) Surigao del Norte 10) Misamis Occidental 10) Agusan del Norte</p>	<p>11) Ilocos Sur (16) Antique (18) Eastern Samar (11) South Cotabato (12) Lanao del Norte (12) Lanao del Sur</p>	<p>(5) Zamboanga del Sur (4) Aurora (10) Occidental Mindoro (14) Quezon (17) Negros Oriental (8) Northern Samar (10) Samar</p>	<p>(5) Zamboanga del Sur (15) Davao Oriental (11) Davao del Sur (11) Sulu (12) Sultan Kudarat</p>
<ul style="list-style-type: none"> <li>With relatively flat plain</li> </ul>		<ul style="list-style-type: none"> <li>More or less mesh type network formed.</li> </ul>	<p>(3) Bulacan (4) Batangas (4) Laguna</p>	<p>(4) Cavite (5) Surabaja</p>	<p>(2) Cavite (3) Alibay (3) Camarines Sur (6) Iloilo (6) Copiz (6) Negros Occidental (8) Leyte</p>	<p>(1) Pangasinan (3) Rizal</p>	<p>(11) Urdaneta del Norte (12) Marikina</p>	
<ul style="list-style-type: none"> <li>Round island</li> </ul>		<ul style="list-style-type: none"> <li>Circumferential road along the coast plus cross-island roads</li> </ul>	<p>(2) Betong (4) Romblon (7) Iloilo (10) Camiguin</p>	<p>(4) Marikina (5) Colondrones (7) Stauffer</p>			<p>(9) Sulu (9) Basilan</p>	
<ul style="list-style-type: none"> <li>Narrow and long island</li> </ul>		<ul style="list-style-type: none"> <li>Comb type or fish-bone type network</li> </ul>			<p>(7) Cebu</p>		<p>(4) Palawan (3) Masbate (9) Tawi-Tawi</p>	

Legend:

- Provincial Boundary
- Mountainous Area
- Primary Road
- Secondary Road
- Study Provinces
- Province Studied in Phase-I Study





## CHAPTER 3

# PROJECT IDENTIFICATION AND SCREENING

### 3.1 METHODOLOGY

#### 3.1.1 General Procedure

The procedure of project identification and screening adopted in this Study is shown in Figure 3.1-1. This procedure concerns such major works as:

- Formulation of basic road network based on functional road classification
- Project identification and screening

##### (1) Functional Road Classification

Since the Study covers all roads except national primary roads defined in Executive Order No. 113, it deals with various classes of roads with different functions. In order to systematically identify, prioritize and select road projects for feasibility studies, roads were functionally classified into two (2) broad categories: Major and Minor Roads.

Major roads are defined as major inter-provincial roads or major intra-provincial roads linking municipal towns or leading to the provincial capital.

Minor roads are roads linking barangays with a municipal town or with a major road network or farm-to-market roads.

Different identification, screening and selection criteria were established for the major and minor roads.

##### (2) Project Identification and Screening

Project screening is the work to decrease the number of projects for the feasibility study by eliminating less feasible projects. The methods of screening applied in this Study are as follows:

###### a) Major Road

Major factors for determining the economic feasibility are the existing surface condition, traffic demand and cost. Project screening is based on a simplified economic analysis which uses these factors as the basis.

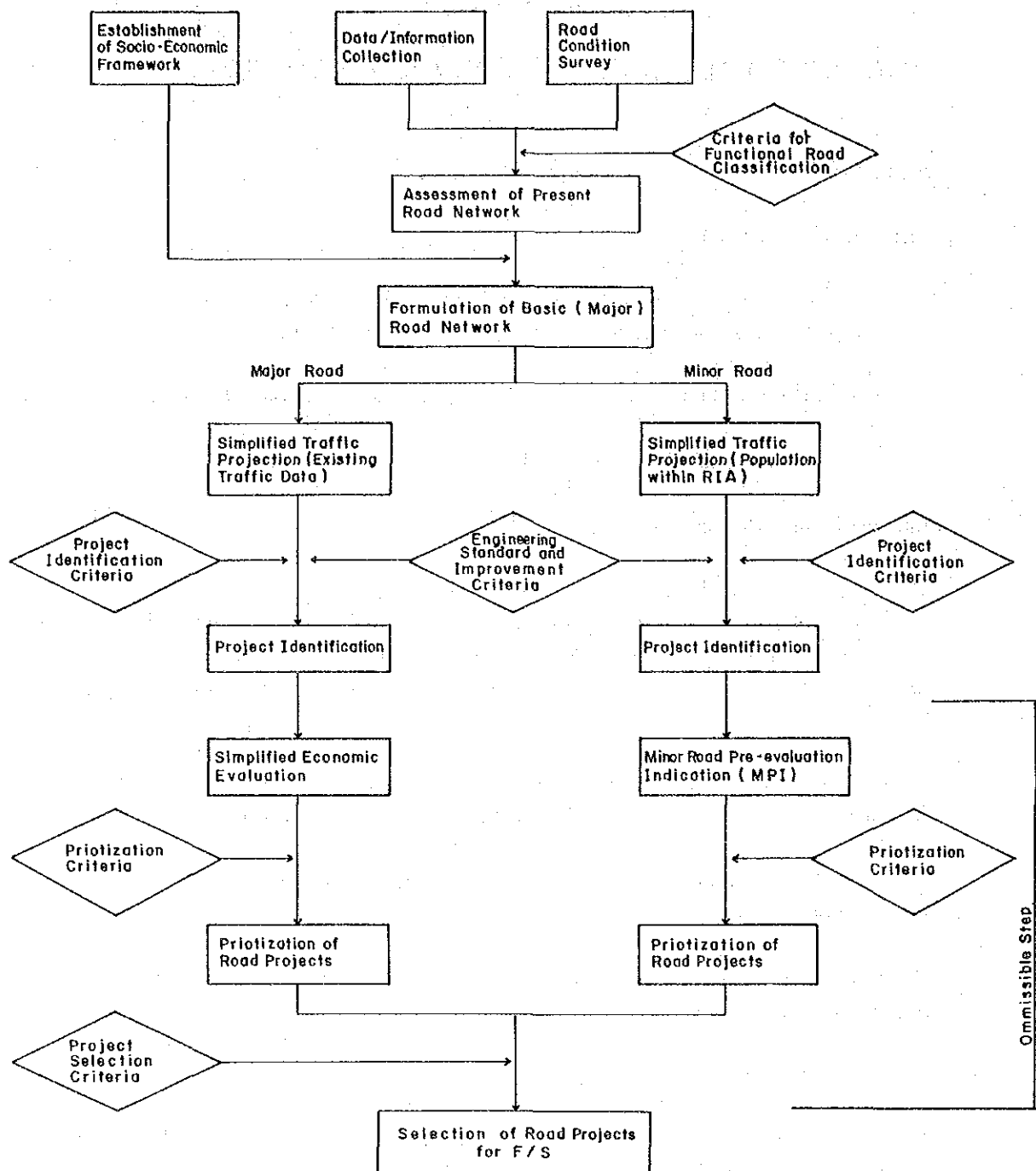


FIGURE 3.1-1 PROCEDURE FOR PROJECT IDENTIFICATION AND SCREENING

**b) Minor Road**

Development benefit as well as traffic benefit are taken into account in the economic analysis of minor roads. Major factors affecting economic feasibility are population and cultivated area in the road influence area, existing road condition and improvement cost. At this stage, however, data on cultivated areas within the road influence area are not available. Therefore, evaluation of minor roads with high accuracy is not possible. As a means to identify projects with less feasibility, "Minor Road Pre-evaluation Indicator (MPI)" was established, which is calculated using only data available at this stage.

It should be noted that project screening is an omissible step, if projects with high priority are identified through engineering judgment and/or development policy. Project screening is also omissible if feasibility study is conducted for all identified projects.

To facilitate feasibility studies, the Simplified Evaluation Method was developed in this Study.

**3.1.2 Data/Information Collection and Road Condition Survey**

**(1) Data/Information Collection**

Various kinds of data/information on roads, traffic and socio-economic conditions of the Study Provinces were collected and analyzed. Table 3.1-1 shows the major data collected.

In utilizing the collected data, the following were considered:

**a) Maps**

Topographical maps of scales 1:50,000 and 1:250,000 being the most reliable maps, they were utilized as base maps for preparing road maps and population distribution maps.

**b) Population**

Barangay population data are available only for 1980. Barangay population in 1990 was projected by using the population growth rate of the corresponding municipality.

**c) Traffic Data**

DPWH's Nationwide Traffic Counting Program (NTCP) provided traffic data for selected national road links. Traffic data of the NTCP and previous similar studies were collected. Traffic volumes for major roads were estimated based on these data. Traffic volumes of minor roads were estimated based on the findings of the Phase I Study.

TABLE 3.1-1 LIST OF COLLECTED DATA

Data/Information	Source
<b>1. Maps</b>	
(1) Topographical Map (1:50,000)	BCGS
(2) Topographical Map (1:250,000)	BCGS
(3) Road Map (1:100,000 or 200,000)	Central Office DPWH, DEO and PEO
(4) Municipal Map (no scale) (showing location of barangay)	Municipalities
(5) Road Map by Municipality (no scale) (showing barangay roads)	Municipalities
<b>2. Road Inventories</b>	
(1) Inventory of National Roads (road name, length, surface type, etc.)	PEO
(2) Inventory of Provincial Roads (road name, length, surface type, etc.)	PEO
(3) Inventory of City Roads (road name, length, surface type, etc.)	CEO
(4) Inventory of Barangay Roads (road name, length, surface type, etc.)	DEO
<b>3. Socio-economic Data</b>	
(1) 1980 Census of Population (population by barangay)	NCSO
(2) Philippine Population Projections 1980-2030 (projected population by municipality)	NEDA
(3) Provincial Profile (land use, list of social service facilities,- production, etc.)	PPDO
<b>4. Traffic Data</b>	
(1) Nationwide Traffic Counting Program (AADT in 1988)	DPWH
(2) Rural Roads Development Program II, 1982	DLG
(3) Philippine Islands Road Feasibility Study, 1980	DPWH
<b>5. Road Project Lists</b>	
(1) List of On-going Road Projects	DEO, PEO, CEO
(2) List of Proposed Road Projects	DEO, PEO, CEO
<b>6. Provincial Development Plan</b>	
(1) Development Plan	PPDO
(2) Infrastructure Investment Program	PPDO

(2) **Road Condition Survey**

The road condition survey was conducted covering all major roads which were established by the Study Team and minor roads which were proposed for improvement by provincial and municipal officials.

The survey was carried out either by the field survey or by the interview survey. The field survey was applied for all road links which were classified as major roads. It was also applied to most national and provincial roads and to some typical barangay roads which were classified as minor roads. The interview survey was conducted for the rest of the minor roads which were mostly barangay roads.

a) **Field Survey**

In the field survey, measured/assessed items consisted of the location, road length, road width, surface type and condition, terrain, alignment, average travel speed, level of motorized access and bridge length.

The data were recorded in the field sheet shown in Table 3.1-2.

b) **Interview Survey**

For most of the minor roads which are proposed for improvement by the local officials, data were obtained by interviewing local officials. The survey team visited each municipality where the proposed roads are located, and talked with the Municipal Engineer or other personnel familiar with the conditions of the roads. The data that was obtained were recorded on the same form as the field survey sheet.

TABLE 3.1-2 ROAD INVENTORY SURVEY SHEET

Road Number;									
Road Name ;									
Link No. (Major Road) / Block No. (Minor Road);									
Location : ( From - To );									
Total Road Length (Km.); ( Km ) - ( Km )									
Subsection No.	Length (Km)	Road Width (m)		Surface Type		Surface Condition		Terrain	Average Speed (km/hr)
		Total Width	Pav't. Width						
a				P G	B E	G V	F I	B N	F R M
b				P G	B E	G V	F I	B N	F R M
c				P G	B E	G V	F I	B N	F R M
d				P G	B E	G V	F I	B N	F R M
e				P G	B E	G V	F I	B N	F R M
f				P G	B E	G V	F I	B N	F R M
g				P G	B E	G V	F I	B N	F R M
h				P G	B E	G V	F I	B N	F R M
Motorized	Total Length of Steep Gradient Sections (km)								
Access	Total Length of Flood Sections (km)								
	Period being Impassable for Vehicles (day/yr)								
Bridges	Ford Crossings	Number							
		Total Length (m)		( )+( )+( )					
	Spillways	Number							
		Total Length (m)		( )+( )+( )					
	Timber Bridges	Number							
		Total Length (m)		( )+( )+( )					
	Bailey Bridges	Number							
		Total Length (m)		( )+( )+( )					
	Steel/Concrete Bridge need Rehabilitation	Number							
		Total Length (m)		( )+( )+( )					
Survey Method	(1) Field Investigation (2) Hearing								
Remarks :									
Date of Survey	19__			Surveyor					