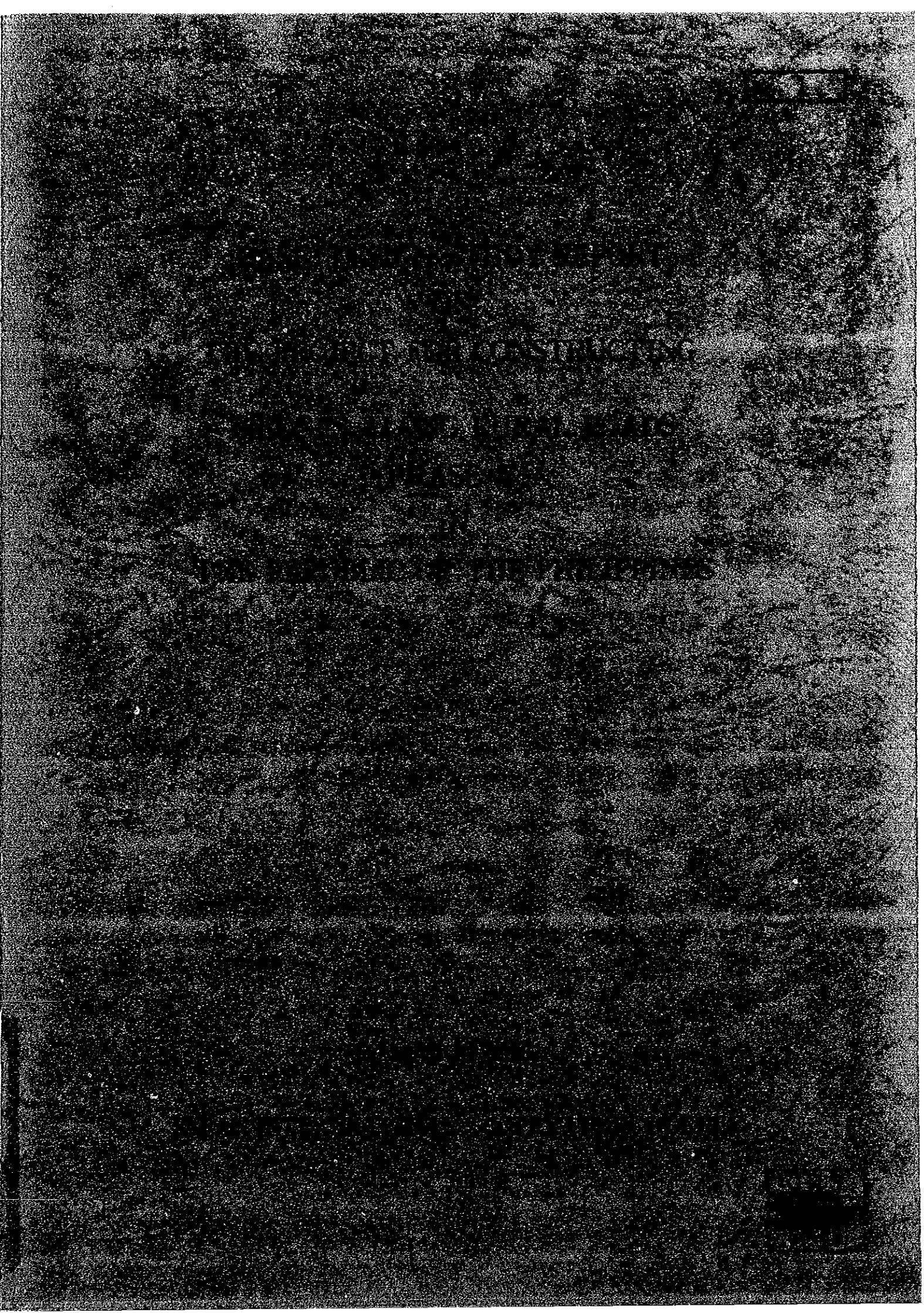


BASIC DESIGN STUDY REPORT

ON

THE PROJECT FOR CONSTRUCTING BRIDGES ALONG RURAL ROADS (PHASE III)

IN

THE REPUBLIC OF THE PHILIPPINES

MARCH 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

P R E F A C E

In response to the request of the Government of the Republic of the Philippines, the Government of Japan has decided to conduct a Basic Design Study on the Project for Constructing Bridges along Rural Roads (Phase III) and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Philippines a survey team headed by Mr. Michio Okahara, Cheif, Foundation Engineering Division, Structure and Bridge Department, Public works Research Institute, Ministry of Construction, from November 19 to December 31 1989.

The team exchanged views with the officials concerned of the Government of the Philippines and conducted a field survey in Region III, IV and I area. After the team returned to Japan, further studies were made. Then, a mission was sent to the Philippines in order to discuss the draft report and the present report has been prepared.

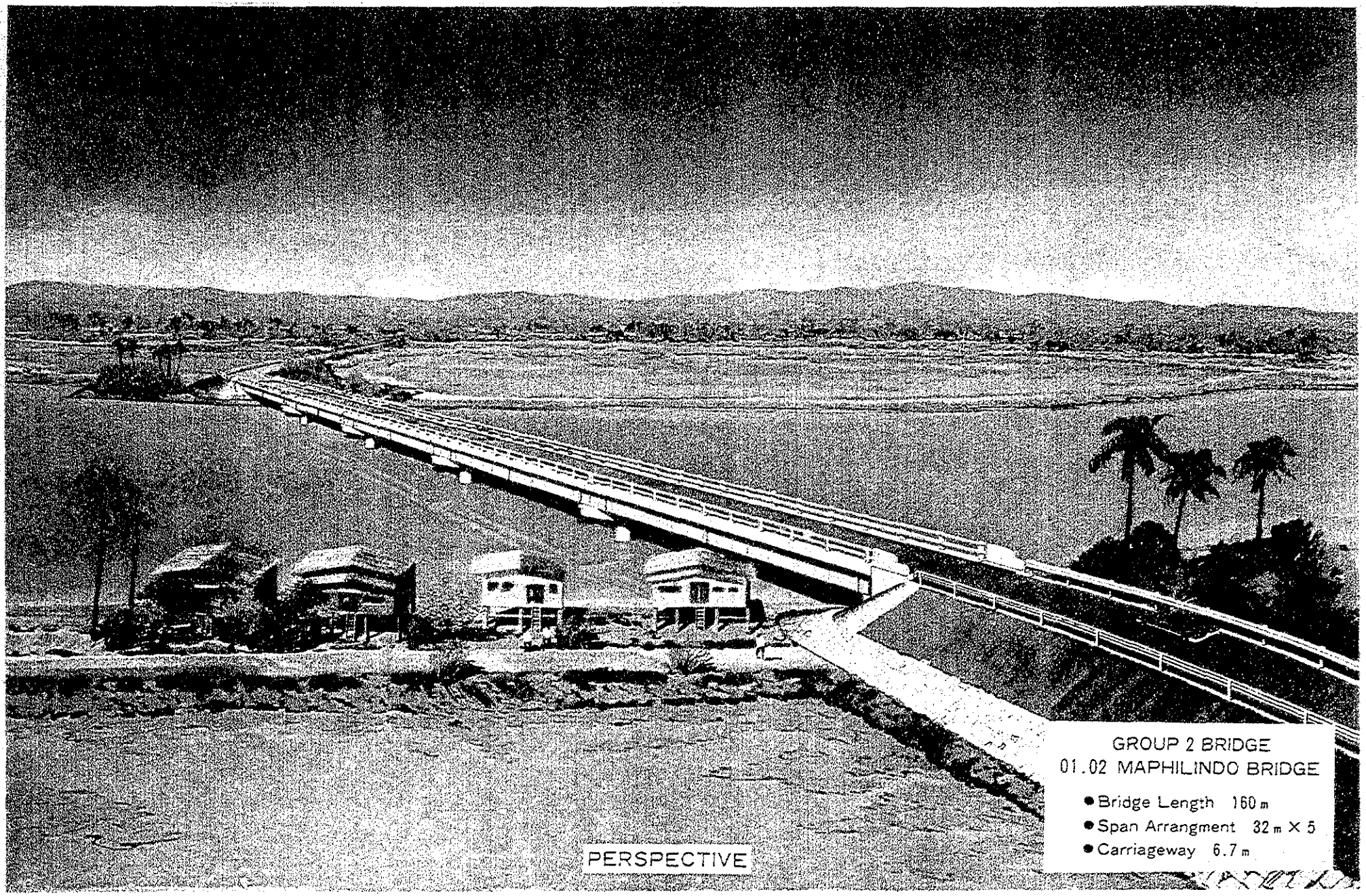
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

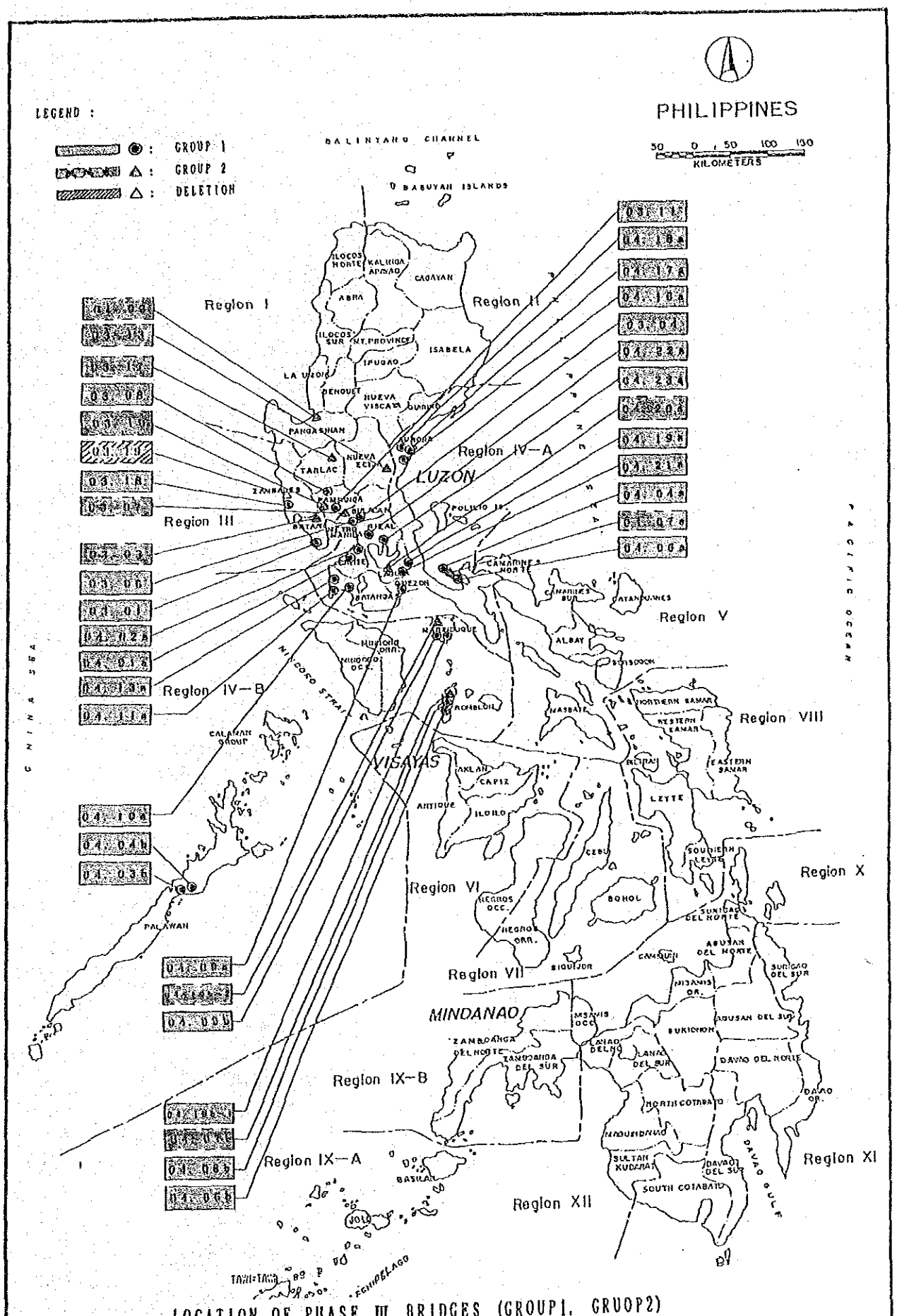
I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

March, 1990

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency


GROUP 2 BRIDGE
01.02 MAPHILINDO BRIDGE
● Bridge Length 160 m
● Span Arrangment 32 m × 5
● Carriageway 6.7 m
PERSPECTIVE



LOCATION OF PHASE III BRIDGES (GROUP1, GRUOP2)

SUMMARY

I. BACKGROUND AND OBJECTIVES OF THE PROJECT

The Government of the Philippines formulated the Medium Term Philippine Development Plan 1987-1992 with strategic policies that shall enable the economy to recover and sustain respectable growth. In order to achieve such economic target, the improvement of transportation facilities in the rural areas is given high priority to promote industrial and agricultural productivity in these areas.

Some of the bridges in the rural areas of the country are already old and dilapidated or are still of temporary timber bridges, which are took weak to carry vehicles (particularly heavy trucks and construction equipment) for transporting materials and equipment for development. Sometimes, there are no bridges or spillway so that traffic are often closed during rainy season. These missing or weak bridges diminish the usefulness of many existing roads resulting in restrained development of the rural areas.

In line with the national development goal of the country, the Government of the Philippines, therefore, has drawn up its development plan with emphasis on the improvement of rural roads, with particular attention to the replacement of temporary or weak bridges with permanent structures.

In this context, the Government of the Philippines requested to the Government of Japan for assistance to replace 58 bridges selected nationwide, in August 1987.

In response to the request of the Government of the Philippines, the Government of Japan decided to conduct basic design study and entrusted to Japan International Cooperation Agency who has executed the study on the project for constructing bridges along rural roads in November 1987 and February 1988. Based on the study, the Government of Japan decided to supply the required steel materials for the superstructures of 24 bridges in April 1988 and construction of 10 bridges in August 1988 under Japan's Grant Aid Program. Named as the Project for Constructing Bridges along Rural Road, the former have been included under the Project's Phase I program while the latter under its Phase II program.

As of March 1990, out of the total 24 bridges programmed under Phase I (to be constructed by the Government of the Philippines), 16 have already been completed and the remaining 8 are schedule to be completed before the end of July 1990. On the other hand, all the 10 bridges programmed under Phase II have been completed by the Government of Japan and are already being operational.

The Government of the Philippines inspired by the favorable impact of the project on the rural development, has formulated a Five-Year Comprehensive Bridge Reconstruction Program for Secondary Roads in April 1989 and has requested the Government of Japan for the implementation of the First Year Program which has been named as the Project for Constructing Bridge along Rural Roads, Phase III.

The bridges included under Phase III are all located along major rural roads in the Philippines same as those under Phases I and II and which are all needed to be replaced urgently due to the improved traffic conditions along rural roads, that provides smooth movement of people and goods to contribute to the socio-economic development of the influence areas.

Note: Spillway: structures with concrete pipes on riverbed and embankment on them

II. PROPOSED BRIDGES

The Five-Year Comprehensive Bridge Reconstruction Program along Secondary Roads aims to replace 264 bridges scattered in the whole country. Under the program, the country is divided into 5 blocks, among which Region III, IV and part of I fall in the area of the first year.

In line with this plan, the Government of the Philippines requested the replacement of 57 bridges in Region III, IV and part of I under the first year of The Five Year Program.

The Government of the Philippines classified the proposed 57 bridges into two groups, Group 1; 32 bridges and Group 2; 25 bridges. Bridges classified under Group 1 are those which the Government of the Philippines can undertake design and construction while those under Group 2 are those to be undertaken by the Japanese side to undertake design and construction.

Listed below is the number of bridges for each group in the Five-Year Comprehensive Bridge Reconstruction Program along Secondary Roads.

	Number of Bridges for Group 1	Number of Bridges for Group 2	Total
1st year	30	25	55
2nd year	31	38	69
3rd year	20	30	50
4th year	20	30	50
5th year	21	19	40
T o t a l	122	142	264

III. BRIEF DESCRIPTION OF PHASE III BRIDGES

Of the 57 bridgs proposed under Phase III, the Study Team has selected 37 bridges appropriate for Japan Grant Aid Program. Selection was made based on the data prepared by the Government of the Philippines prior to the field survey of the Study Team, taking into consideration the urgency in bridge replacement, population in influence areas, access condition between project sites and population centers, and future improvement plan of prject roads. The selected 37 bridges were subjected to basic design study.

The reasons for excluding the 20 bridges are as follows:

- Long length and involves high construction cost due to flooded area, with impact bridge reconstruction considered relatively small : 9 bridges
- Have minor damages and are still operational : 6 bridges
- Access road is in bad condition so that transportation of construction equipment and materials considered difficult : 2 bridges
- Being used only by pedestrian with replacement not urgently required : 2 bridges
- Bridges under construction which the Government of the Philippines requested to withdraw : 1 bridge

The selected 37 bridges for Phase III were divided into two groups, Group 1; 27 bridges and Group 2; 10 bridges.

Group 1 Bridges are defined as those with short length and which can easily be designed and involves erection of steel girders. Therefore, the Government of Japan limited the grant only for the supply of steel materials required for the bridges.

Group 2 Bridges, on the other hand, are defined as those that the required level of engineering is relatively high because of (1) erection of steel girders in valley, (2) long span, (3) requirement of temporary cofferdam for construction of pier in river and (4) necessity of geological investigation including boring for determination of bridge foundation and topographical survey due to under related topography, Therefore, the Government of Japan extend the grant no only for the supply of steel material, but also detailed engineering and construction.

The number of bridges and bridge length selected for Group 1 and 2 by province and region are shown in the following table.

Number of Selected Bridge by Province and Region

Region	Province	Group - 1				Group - 2				TOTAL			
		Number of Bridge		Bridge Length (m)		Number of Bridge		Bridge Length (m)		Number of Bridge		Bridge Length (m)	
		Request	Selected	Request	Selected	Request	Selected	Request	Selected	Request	Selected	Request	Selected
I	Pangasinan	(0)	0	(0)	0	(2)	1	(245)	160	(2)	1	(245)	160
III	Bataan	(2)	1	(48)	24	(1)	1	(46)	52	(3)	2	(94)	76
	Bulacan	(2)	2	(39)	60	(2)	1	(116)	54	(4)	3	(155)	114
	Pampanga	(2)	2	(30)	69	(2)	1	(210)	48	(4)	3	(240)	117
	Nueva Ecija	(2)	0	(48)	0	(0)	1	(0)	96	(2)	1	(48)	96
	Tarlac	(0)	0	(0)	0	(4)	1	(447)	60	(4)	1	(447)	60
	Zambales	(0)	1	(0)	30	(2)	0	(94)	0	(2)	1	(94)	30
IV-A	Carite	(2)	2	(43)	45	(1)	0	(66)	0	(3)	2	(109)	45
	Quezon	(5)	3	(95)	95	(1)	1	(50)	44	(6)	4	(145)	139
	Batangas	(1)	3	(20)	98	(4)	0	(206)	0	(5)	3	(226)	98
	Aurora	(2)	3	(40)	95	(2)	0	(140)	0	(4)	3	(180)	95
	Laguna	(2)	2	(42)	48	(1)	1	(44)	45	(3)	3	(86)	93
	Rizal	(2)	2	(40)	47	(0)	0	(0)	0	(2)	2	(40)	47
IV-B	Palawan	(3)	2	(60)	60	(1)	0	(35)	0	(4)	2	(95)	60
	Romblon	(3)	2	(65)	60	(1)	1	(30)	36	(4)	3	(95)	96
	Marindoque	(4)	2	(38)	54	(0)	1	(0)	46	(4)	3	(38)	100
	Oriental Mindoro	(0)	0	(0)	0	(1)	0	(60)	0	(1)	0	(60)	0
TOTAL		(32)	27	(608)	785	(25)	10	(1,789)	641	(57)	37	(2,397)	1,426

NOTE : Figures in ( ) proposed number and length of bridges
Figures without ( ) selected number and length Of bridges

The main features of Group 1 and 2 are as follows:

	Group 1 Bridges	Group 2 Bridges
Total No. of Bridges	27	10
Total Length of Bridges (m)	785	641
Length of of Span (m)	15,18,21,22,23,24	15,18,20,22,23,24, 26,30,32
Number of Spans	.One span - 16 Br. .Two Span - 11 Br. 38 Spans 27 Br.	.Two Span - 6 Br. .Three Span - 2 Br. .Four Span - 1 Br. .Five Span - 1 Br. 27 spans 10 Br.
Width of Bridges (m)	.Total Width 8.32 .Roadway 3.35 m x 2 Lanes .Sidewalk 0.42 m x 2 Lanes	
Type of Superstructures	.H-Beam Composite Girder - 27 Br.	.H-Beam composite Girder - 7 Br. .Built-up Steel Girder - 3 Br.
Type of Substructures	Abutments: T-Type Abutments (Spread or Pile) Piers: Column-Type Piers (Spread or Pile)	
Cofferdams	Earth Cofferdams	Steel Sheet Pile Cofferdam
Approach roads (m)	Roadways 3.35 m x 2 Lanes Shoulders 1.0 x 2 Lanes Portland Cement Concrete Pavement Asphalt concrete Pavement	
River Bank Protection	Grouted Riprap	

IV. Scope of Both Governments

(1) Scope of the Government of Japan

Japan Grant Aid will be extended to the construction of bridges, related structures and approach roads, including the supply of steel materials, as follows:

	Group 1 Bridges	Group 2 Bridges
1) Supply of Steel Materials		
.H-Beams and Others (t)	1,010	527
.Built-up Steel and Others (t)	-	348
.Steel Sheet Piles and Others (t)	-	258
.Steel Railings and Posts for Bridge Approaches (m)	1,836	680
2) Construction of Structures		
.Deck Slabs and Bridges (m^2)	-	5,444
.Abutments (each)	-	20
.Piers (each)	-	17
.Concrete Pipes (m)	-	4,134 (314 each)
.River Bank Protection (m^2)	-	4,741
3) Construction of Approach Roads (m)	-	2,434

(2) Scope of the Government of the Philippines

		Group 1	Group 2
- Construction of Structures			
.Abutments	(each)	54	-
.Piers	(each)	11	-
.Concrete Pipes	(m)	6,560 (656) each	-
.River Bank protections	(m^2)	10,125	-
- Construction of Approach roads	(m)	405	-
- Delivery of Steel Materials and Erection		1,010	-

.Acquiring the right of way
.Demolishing obstacles including houses
.Providing the necessary land area for the works
.Maintenance of the transportation roads
.Repairing the old bridges along transportation Road

V. Project Cost for the Project

The project cost necessary to the project for the Government of the Philippines was roughly estimated.

Scope of the Government of the Philippines

Group 1 Bridges	Group 2 Bridges
.Construction Cost of Substructure and Approach Road .Domestic Transportation Cost of Steel Materials and Cost of Erection Works .Miscellaneous Expenses	.Cost for Rehabilitation of Roads and Bridges Leading t Project Sites .Cost for Road Maintenance .Cost for Land Acquisition and House Demolition .Cost for Necessary Land for Construction Works
Total 490 Million Yen	40 Million Yen

VI. Construction Schedule

The construction schedule is tentatively programmed as follows:

	Group 1 Bridges Japan; Steel Material Supply Philippines: Construction	Group 2 Bridges Japan; Steel Material and Construction
. Detailed Design	3.5 Months	3.0 Months
. Tendering	5.0 Months	2.0 Months
. Construction	12.0 Months	12.0 Months

VII. Executing Agency

The executing agency of the Government of the Philippines for the Project is the Department of Public Works and Highways (DPWH). The Bureaus of Design, Construction and Maintenance, and Regional Offices of the DPWH are also responsible for their corresponding activities.

(1) Group 1 Bridges

1) Bureau of Design: Design and Cost Estimates

- Design and cost estimates of substructures
- Transportation of steel materials (from designated port to bridge sites) and cost estimates of temporary facilities
- Design and cost estimates of slabs and walls and others
- Design and cost estimates of drainage system, culvert and others
- Design and cost estimates of river bank protection
- Design and cost estimates of bridge approaches road

2) Bureau of Construction: Tendering

- Drawing up contract document of construction cost, specifications, prequalification and so on
- Implementation of tendering

3) Bureau of Maintenance; Maintenance

- Rehabilitation and Maintenance of transportation roads and bridges for steel materials to bridge sites

4) Regional Offices: Supervision, direction and supervision of construction for the project each region

(2) Group 2 Bridges

Design and construction supervision will be executed by a Japanese consultant.

The four (4) Executive Bureaus are to have discussions and to contact and coordinate with the Japanese Consultant in order to complete the Project.

VIII. CONCLUSION AND RECOMMENDATIONS

(1) Conclusion

The Government of the Republic of the Philippines has given high priority to the improvement of rural roads (farm to martket roads) in the highway sector of the Development Plan.

In line with this policy, the Government of the Philippines has formulated a Five-Year Comprehensive Bridge Reconstruction Program for Secondary Roads. The Program basically calls for the replacement of old and dilapidated bridges along secondary roads with permanent structures with the aim of promoting development and to sustain economic growth in the rural areas.

The Program which will ensure safe and efficient transport of people and agricultural products in the rural areas throughout the dry and wet seasons is expected to have a considerable impact on the development of the country. Implementation of this project therefore under Japan's Grant Aid is considered justified and appropriate.

(2) Recommendation

From the experience of Phase I and II, some measures are considered necessary for the smooth implementation of the projects under the Program, viz:

1) The establishment of the proper organization, commitment of technical resources and selection of contractors in the implementation of the projects.

- o At present, regional offices are responsible for supervising the construction of Phase I bridges. However, it is suggested that the Bureau of Construction and Bureau of Design of the DPWH should have greater role and participate more aggresively in the implementation of the Program.
- o For the proper implementation of this Project, DPWH should commit the necessary number and level of engineers required by the project.
- o Local contractors should be carefully selected and the reasonable construction cost should be analyzed. Any delay in construction due to changes in the contractors should be avoided.

2) The Government of the Philippines should allocate the necessary budget for implementation of the project.

3) Prior to h e commencement of the Project, the following works should already be completed.

- o Acquisition of right-of-ways
- o Demolition of houses
- o Rental of land for construction works

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SEPARATE VOLUME

1. Drawings

2. Hydrographic Data

3. Topographic Data

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CHAPTER 1

INTRODUCTION

CHAPTER I

INTRODUCTION

In response to the request of the Government of the Philippines, the Government of Japan decided to conduct the Basic Design Study on the Project for Constructing Bridges along Rural Roads (Phase III) (hereinafter referred at the Phase III Study) and Japan International Cooperation Agency (hereinafter referred to as JICA) dispatched the Basic Design Study Team to the Philippines from 19th November to 31st December 1989 for a field investigation. Through the discussion of a Draft Final Report with the Government of the Philippines, (from 1st to 8th March 1990), the Final Report of Basic Design Study was prepared.

The mission has selected the 37 bridges appropriate to Japan Grant Aid among the 57 bridges proposed for Phase III, taking into consideration the urgency of bridge replacement, the population of the influence area, the access condition between the project site and main cities, and the socio-economic impact. The mission, further conducted the field investigation, and topographical and geotechnical survey of the project area with official concern of the Philippine Government (refer to Appendix 1).

The Minutes of Discussions on the Phase III Study was signed on November 28, 1989. (Refer to Appendix 2).

The Project involves the construction of new bridge and the replacement of dilapidated bridges along rural roads in the region III, IV and a part of I as the first year program of the Five-Year Comprehensive Bridge Reconstruction Program along Secondary Roads.

Based on the engineering point of view, the selected 37 bridges were classified into two (2) categories: Group 1; 27 bridges, Group 2; 10 Bridges. Group 1 bridges are defined as that the Government of the Philippines can construct with the steel materials supplied by the Government of Japan, while Group 2 bridges are those that execution the design and construction is suitable for the Government of Japan.

The mission carried out the field investigation including topographical and geotechnical surveys for 10 bridges of Group 2.

Data and information collected in the field were further analyzed in Japan. As result of the analysis, Final Report of Basic Design Study was prepared.

CHAPTER 2

BACKGROUND OF THE PROJECT

CHAPTER 2

BACKGROUND OF THE PROJECT

2.1 Present Condition of Highways and Bridges

2.1.1 Present Condition of Highways

Of the four (4) transport modes, namely road, rail, sea and air transport, road transport is dominant in the Philippines. The road network has been developed rapidly in the last two (2) decades, and carries 77.7% of passenger and 46.5% of freight traffic. Almost all intra-island transport in the rural areas depends on road transport. See Table 2.1-1.

TABLE 2.1-1 APPROXIMATE NATIONAL MODAL SPLIT, 1985
(DOMESTIC TRAFFIC ONLY)

Mode	Freight		Passenger	
	Ton-km (Billion)	Share (%)	Passenger-km (Billion)	Share (%)
Sea	11.90	(49.4)	5.08	(8.6)
Road	11.20	(46.5)	46.00	(77.7)
Rail	0.97	(4.0)	3.05	(5.1)
Air	0.04	(0.1)	5.08	(8.6)

Source: NEDA

As shown in Table 7 of Appendix 9, the Philippines has a total road length of 157,664 km; of which 17% are classified as national roads, 18% as provincial roads, 3% as city roads, 8% as municipal roads and 54% as barangay roads.

Only 9,555 km (6%) of the roads are made of concrete surface, 12,552 km (7%) asphalted and the remaining 135,557 km of unpaved surface, consisting of gravel roads (80%) and earth surface (6%). Most concrete paved stretches are national roads for a total of 6,180 km (or 65%). Provincial and city roads have approximately 1,363 km (14%) of concrete pavement, while municipal roads have 2,012.25 km (21%).

Relative to the projected 1985 population, the country has 3 km of road for every 1,000 persons. The regions with very high road lengths per thousand population are Regions I, II, IV-B, X, XI, and XII, while the regions with very low road lengths per thousand population are NCR and Southern Tagalog.

The present highway network is observed to have the following deficiencies:

(a) About 44% of the national road network is paved with concrete or asphalt, but only 14% of total area roas is paved.

(b) The condition of many roads, especially barangay (feeder) and provincial (secondary) roads and even some national road sections, is poor because of initial low design standards relative to traffic volume, sub-standard construction, inadequate maintenance and damage from over-loaded vehicles.

(c) Missing or weak bridges diminish the usefulness of many existing roads.

(d) In some remote areas, access roads connecting with arterial or major rural roads are scarce.

2.1.2 Present Condition of Bridges

The Philippines has a total of 253,519 linear meters of bridge structures in 1988, of which 77% are permanent and 23% are temporary. The temporary bridges are Bailey with wooden trestles, timber, etc.

These bridges are dilapidated and dangerous and are often closed to traffic, especially during the rainy season. This situation has been regarded as one of the main constraints on development in rural areas.

The region with the largest percentage of temporary to permanent bridge length is Region XI (42%), followed by Regions VIII (39%), CAR (35%) and IV-B (32%). While, the region with the shortest length of temporary bridges is NCR with 1%, followed by Regions I (5%), III (7%) and IV-A (12%) as shown in Table 2.1-2.

The deficiencies of bridges in the Philippines are observed as follows:

- Temporary timber trestle bridge is always damaged by flood resulting in frequent repairs of timber parts.
- Maintenance cost of the long span temporary bridge is excessive.
- Repair work is very expensive and has to be done very frequently.
- Existing bridge is out of alignment.
- Capacity of existing bridge may not conform with the live loads passing over the bridge, so that heavy equipment and other heavy cargo trucks cannot cross the bridge safely.
- Some of bridges are flooded during rainy seasons resulting in closure to traffic.

Table 2.1-2 EXISTING BRIDGE BY CLASSIFICATION AND STANDARD

ALONG NATIONAL ROADS ONLY

1988

Region	Total Number of Bridge	Length According to Type of Structure							TOTAL (m)
		Parmanent		Total		Temporary		Total		
		Concrete (m)	Steel (m)	(m)	(%)	Bailey (m)	Timber (m)	(m)	(%)	
NCR	271	12,837.98	495.75	13,333.73	(99%)	97.54		97.54	(1%)	13,431.27
CAR	241	2,821.15	2,113.97	4,935.12	(65%)	2,429.20	170.50	2,599.70	(35%)	7,534.81
I	430	10,031.77	8,281.03	18,312.80	(95%)	937.64	92.60	1,030.24	(5%)	19,343.04
II	425	7,220.79	8,165.25	15,386.04	(84%)	1,350.48	1,588.10	2,938.58	(16%)	18,324.62
III	521	16,285.54	1,862.06	18,147.60	(93%)	770.25	627.00	1,397.25	(7%)	19,544.86
IV-A	568	10,022.45	2,485.05	12,507.50	(88%)	1,166.79	458.52	1,625.31	(12%)	14,132.81
IV-B	526	9,009.02	1,309.18	10,318.20	(68%)	2,614.44	2,141.55	4,755.99	(32%)	15,074.19
V	325	9,077.05	1,598.75	10,675.80	(73%)	2,425.80	1,547.34	3,973.14	(27%)	14,648.94
VI	606	14,165.73	3,207.80	17,373.53	(72%)	4,463.59	2,163.79	6,627.38	(28%)	24,000.91
VII	485	7,475.61	2,090.16	9,565.77	(73%)	2,717.84	884.31	3,602.15	(27%)	13,167.92
VIII	894	10,997.03	4,207.91	15,204.94	(61%)	3,692.94	6,194.37	9,887.31	(39%)	25,092.25
IX	260	5,516.34	1,442.39	6,958.73	(80%)	1,214.40	530.10	1,744.50	(20%)	8,703.23
X	596	10,479.69	3,166.59	13,646.28	(75%)	2,137.13	2,525.42	4,662.55	(25%)	18,308.83
XI	461	7,013.58	1,535.67	8,549.25	(58%)	3,068.80	3,124.64	6,193.44	(42%)	14,742.69
XII	319	5,745.04	916.55	6,661.59	(70%)	2,339.11	468.60	2,807.71	(30%)	9,469.30
Total	6,928	138,698.77	42,878.11	181,576.88	(77%)	321,576.94	22,516.84	53,942.79	(23%)	235,519.67

2.2 Outline of Related Development Plans

2.2.1 National Development Plan

The Philippine Government published in January 1987 the "Medium-Term Philippine Development Plan 1987-1992". The plan analyses the cause of the minus economic growth starting in late 1983 and the present conditions, and sets the new goals of the government. The principal goal is the restoration of the economy which will lead to the alleviation of poverty and increase in employment opportunities. (Present unemployment rate : 11.8%; part-time employment rate : 35.2%). The major economic indexes of the Philippines are shown in Table 5 of Appendix 9. The composition of expenditures is shown in Table 6 of Appendix 9.

The main points of the Plan are as follows:

(1) National Development Goals

The following four (4) goals are addressed. Their accomplishment fully depends on economic growth and the Plan emphasizes that cooperation between the public and private sectors is indispensable.

a) Alleviation of poverty.
b) Generation of more productive employment.
c) Promotion of equity and social justice.
d) Attainment of sustainable economic growth.

(2) Economic Indexes for National Development Goal

As a target for economic growth, an average growth rate of GNP of 6.8% per annum is expected for the six years from 1987 to 1992. An inflation rate of 7.6% per annum and a GNP per capita at 22,378 pesos ($1097 @, $1=20.4 pesos) in 1992 are also forecast. Refer to Table 2.2-1.

TABLE 2.2-1 GROSS NATIONAL PRODUCT AND PER CAPITA GNP, 1986-92

	Estimate	Targets						Annual Average
	1986	1987	1988	1989	1990	1991	1992	1987-92
Gross National Product (in billion pesos, at constant 1972 prices)	89.4	95.3	101.9	108.6	116.2	124.3	132.7	113.2
Growth rate (%)	1.1	6.5	6.9	6.7	7.0	6.9	6.7	6.8
Gross National Product (in billion pesos, at current prices)	619.6	697.3	811.8	927.3	1,075.7	1,253.2	1,438.0	1,033.9
Inflation Rate (%)	2.0	5.2	8.7	7.0	8.3	8.9	7.4	7.6
Per Capita GNP (in pesos, at constant 1972 prices)	1,597	1,661	1,734	1,808	1,891	1,977	2.064	1,856
Growth rate (%)	-1.3	4.0	4.4	4.3	4.6	4.5	4.4	4.4
Per Capita GNP (in pesos, at current prices)	11,063	12,157	13,825	15,430	17,497	19,934	22,378	16,870

Sources: NEDA AND NCSO

2.2.2 Highway Development Plan

The Medium-term Philippine Development Plan 1987-1992 sets out the following policies and strategies for the highway sector, as follows.

In line with the stress on the development of the rural-agricultural sector, increased emphasis will be given to the rehabilitation, improvement and expansion of the feeder and secondary network, which consists mainly of farm-to-market roads. The program seeks to convert these roads into all-weather transport facilities. These roads will be underscored particularly in economically depressed areas with low road densities to spur production. Feeder and secondary roads will also be improved in corridors of main highways which have just been or are programmed to be improved; this will provide for a more efficient network to collect and distribute traffic to and from the hinterlands.

Rehabilitation and improvement of major roads will be selectively carried out, particularly in sections, as in Mindanao and Visayas, that can no longer economically serve the present and immediate future traffic volume, and where transport costs are so excessively high that they restrain production and marketing.

Temporary or weak bridges will be replaced with permanent structures. Measures will be introduced to stabilize road slopes and embankments and to strengthen pavements to minimize road disasters and closures. This will be complemented by schemes, both structural and nonstructural, to reduce the rate of accidents and to improve road traffic safety.

Road maintenance activities will be reinforced in order to defer the huge investments in roads, lengthen their useful lives, reduce transport operating costs and minimize public inconvenience. For this purpose, the inspection, monitoring and accounting system for maintenance will be strengthened.

Table 2.2-2 is shown Road Development Plan from 1986 to 1992.

The physical targets 1986-92 in the Highway Development Program are shown in Table 2.2-2.

TABLE 2.2-2 HIGHWAY DEVELOPMENT PROGRAM
PHYSICAL TARGETS 1986-92

	Program 1986	Targets 1987	1988	1989	1990	1991	1992	1987-92 Total	% of Total
Roads (in km)	6,475	9,319	10,000	10,538	11,708	12,704	13,711	68,078	100.0
Feeder Roads (inc. barangay roads)	4,702	6,876	9,458	7,610	8,551	9,255	9,963	49,713	73.0
Secondary Roads (inc. national roads)	1,263	1,403	1,545	1,712	1,856	2,052	2,270	10,838	15.9
Major Roads	510	1,040	1,097	1,214	1,301	1,397	1,478	7,527	11.1
Bridges (in lineal meters)	4,899	5,059	5,624	6,219	6,860	7,683	8,465	39,920	

(a) Restoration, rehabilitation, improvement and construction.
Sources of basic data: DPWH, DLG

2.2.3 The Project for Constructing Bridges Along Rural Roads (Phase I) and (Phase II)

This project (Phase III) is the continuation of Phase I and Phase II and the contents are as following.

The Government of the Philippines aims to reinforce the physical foundation of the economy to support the overall development thrust of sustained economic growth, economic efficiency and recovery. It seeks to establish and improve essential transport facilities in rural areas to increase activities in these areas for greater production and to induce direct investment therein.

It has been pointed out that some of the bridges in rural areas are old and temporary wooden bridges which are often closed to traffic, especially during the rainy season. Missing or weak bridges diminish the usefulness of many existing roads. This situation has been regarded as one of the main constraints on development in rural areas.

The replacement of these old temporary and dilapidated bridges by permanent steel structures will ensure fast, safe and smooth land transportation, which will certainly contribute to the socioeconomic development of these areas.

The implementation of the Project is proposed in line with the Highway Development Strategy as envisioned in the Medium-Term Philippine Development Plan 1987-1992.

In the initial project, the Government of the Philippines had proposed the replacement of 58 bridges which are old and temporary. The study mission divided these 58 bridges into Phase I and Phase II in view of the technic reviewing existing data.

Phase I were composed to 24 bridges which were easy to construct with steel materials supplied by Japan. Phase II were composed to 10 bridges that it is suitable to make design and construction by Japan. Both of the Government concluded the Exchange Note for Phase I in April 1988 and for Phase II in October 1988. And the Government of Japan committed the grant aid. Refer to Table 2.2-3.

TABLE 2.2-3 PHASE I AND PHASE II STUDY

Title of Study	Contents of Study	Duration of Study
Phase I Basic Design Study	Basic design of superstructures of bridges subject to steel material supply	November 1987 - January 1988
Phase II Basic Design Study	Basic design of superstructures and substructures of bridges subject to construction	February 1988 - June 1988
Phase I Detailed Design and Construction Supervision	Detailed design and construction supervision of superstructures subject to steel material supply	May 1988 - March 1989
Phase II Detailed Design and Construction Supervision	Detailed design and construction supervision of bridges subject to construction	October 1988 - March 1990

2.2.4 Five Year Comprenhensive Bridge Reconstruction Program along Secondary Roads

The project for constructing bridges along rural roads (Phase I and II) was emphasized as one of major projects in highway development plan. Inspired by the effect of the project, the Government of the Philippine formulated the Five Year Comprehensive Bridge Reconstruction Program to continue the project in April 1989.

The priority of regions for implementation of the project was determined based on the following 5 criteria and construction convenience.

- o Population
- o Number of worker
- o Incidence of poverty
- o Agricultural development potentiality
- o Length of temporary bridge

The Five Year Prograis planned to improve 264 bridges throughout the country which is divided into 5 blocks. This study (Phase III) covers Region III, IV and a part of I. Table 2.2-4 shows the priority of regions and Figure 2.2-1 graphically demonstrate its location.

Table 2.2-5 presents number of bridges to be improved in each year.

- o 1st year: Region III, IV and a part of I
- o 2nd year: Region V, VI, VII and VIII
- o 3rd year: Region X and XI
- o 4th year: Region IX and XII
- o 5th year: Region I, II and CAR

The Government of the Philippines classified these bridges into two groups, Group 1 which the Government can undertake design (excluding superstructure) and construction, and Group 2 which is considered to be suitable for Japanese side to execute design and construction.

TABLE 2.2-4 PRIORITIZATION OF REGION

Region	Population			Number of Workers			Incidence of Poverty		Agriculture		Temporary Bridges			Total Order	Package
	Person	%	Order	Person	%	Order	%	Order	%	Order	L.M.	%	Order		
All Philippines	54,068,749	100		14,197,122	100		59.3		100		55,589.21	100			
I	3,902,557	7.1	6	988,785	7.0	5	52.3	11	6.5	8	2,367.51	4.3	10	40	⑤ 44.5
II	2,520,978	4.6	12	142,475	4.5	11	54.6	10	5.3	10	4,324.68	7.8	6	49	
III	5,456,130	10.0	2	1,388,123	9.8	2	44.4	12	9.7	3	770.99	1.4	12	31	① 23.5
IV	7,089,369	13.0	1	1,825,029	12.9	1	55.9	9	15.5	1	7,199.20	12.9	3	15	
V	3,921,555	7.2	5	920,308	6.5	7	73.2	1	6.6	7	3,312.51	5.9	8	28	② 25.0
VI	5,092,415	9.3	3	1,320,035	9.3	3	73.1	2	11.3	2	7,634.22	13.7	2	12	
VII	4,195,009	7.7	4	1,236,141	8.7	4	68.8	4	5.9	9	3,795.74	6.8	7	28	
VIII	3,072,760	5.6	9	788,603	5.6	8	70.4	3	4.7	11	10,379.41	18.7	1	32	
IX	2,862,983	5.2	10	681,943	4.8	10	65.3	7	8.0	5	1,796.01	3.2	11	43	④ 42.0
X	3,178,586	5.8	8	762,706	5.4	9	66.2	6	6.9	6	5,391.98	9.7	5	34	③ 30.5
XI	3,836,461	7.0	7	948,917	6.7	6	61.7	8	11.3	2	5,792.04	10.4	4	27	
XII	2,597,722	4.8	11	597,624	4.2	12	65.2	5	8.3	4	2,720.92	4.9	9	41	

Note: Excluding NCR
: CAR included in Regions I and II
: Regions IV-A and IV-B are combined in Region IV

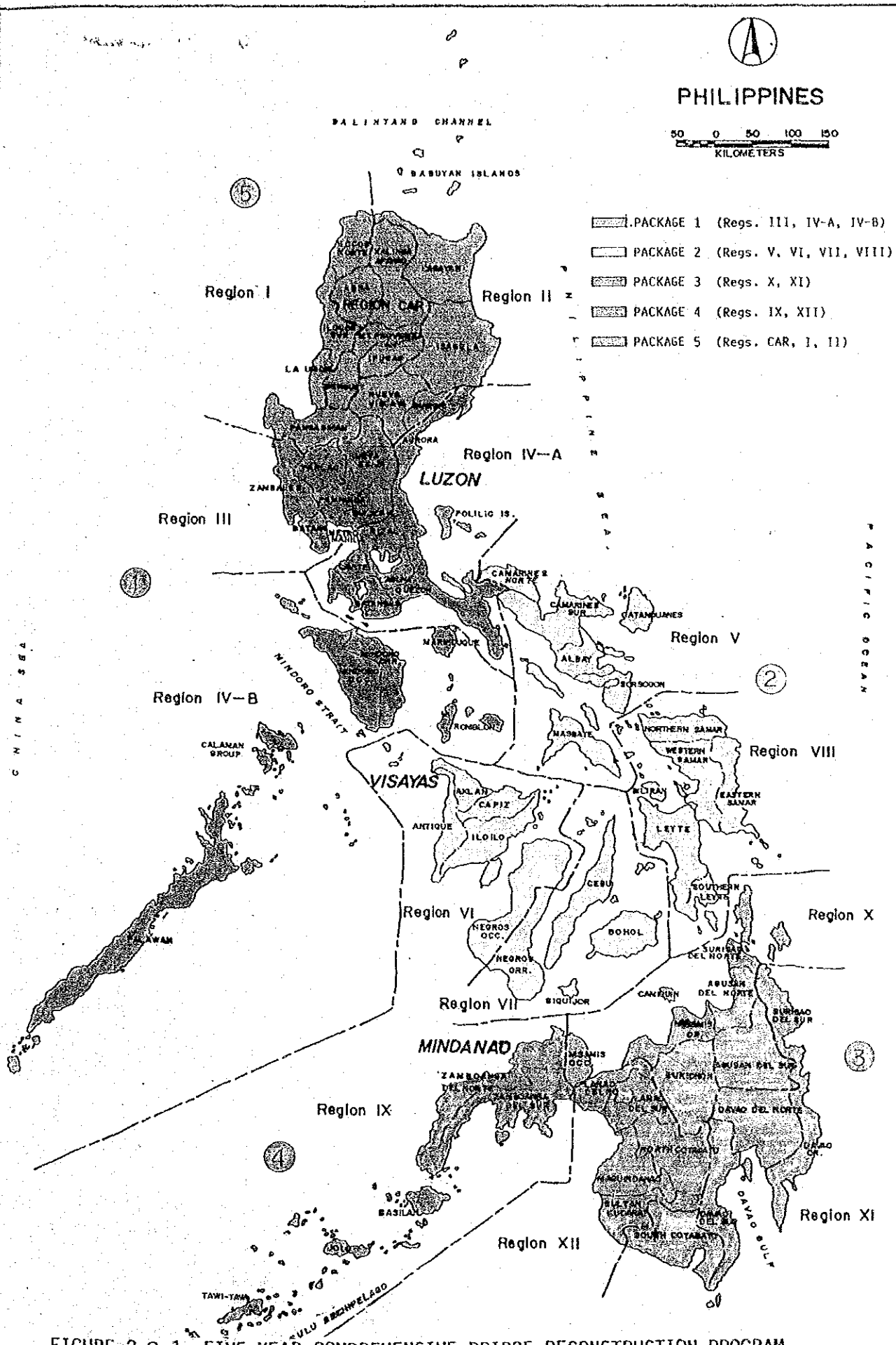

FIGURE 2.2-1 FIVE-YEAR COMPREHENSIVE BRIDGE RECONSTRUCTION PROGRAM ALONG SECONDARY ROADS

TABLE 2.2-5 SUMMARY OF PROPOSED BRIDGE BY PACKAGE/GROUP

Package Number	Region	Number of Proposed Bridge Group 1	Group 2	Total
1st year	I	-	2	2
	III	8	11	19
	IV - A	14	9	23
	IV - B	8	3	11
	Total	30	25	55
2nd year	V	11	7	18
	VI	6	10	16
	VII	6	12	18
	VIII	8	9	17
	Total	31	38	69
3rd year	X	15	18	33
	XI	5	12	17
	Total	20	30	50
4th year	IX	9	10	19
	XII	11	20	31
	Total	20	30	50
5th year	CAR	10	9	19
	I	3	3	6
	II	8	7	15
	Total	21	19	40
GRAND TOTAL		122	142	264

2.3 CONTENTS OF THE PROJECT

2.3.1 Background of the Project

The Republic of the Philippines proposed the Medium-Term Philippine Development 1987-1992 which aims the economic recovery and its sustained growth. In the highway sector of the Development Plan, the project for constructing bridges along rural roads (Phase I and II) was given a high priority. Cognizant with the effect of the project, the Government of the Philippines formulated the Five-Year Comprehensive Bridge Reconstruction Program along Secondary Roads.

As the first year program of the Five-Year Plan, reconstruction of bridges in Region III, IV and a part of I was requested to the Government of Japan, which is named as the Project for Constructing Bridges along Rural Roads (Phase III) and subject to the Basic Design Study.

2.3.2 Contents of the Project

The project (Phase III) is the continuation of bridge reconstruction program along rural roads under which Phase I and II were implemented. The Government of the Philippines requested the Government of Japan the replacement of 57 bridges in Region III, IV and a part of I, as the first year program of the Five-Year Plan.

The Government of the Philippines classified 57 bridges into two groups, Group 1 and 2. Group 1 is defined as bridge that the required level of engineering is relatively easy for the Philippine side to design and construct bridges by using steel materials supplied by the Government of Japan. On the other hand, Group 2 is defined as bridges that the required level of engineering is relatively high and suitable for the Japanese side to design and construct. The number of bridges subject to Group 1 and 2 is 32 and 25, respectively.

In the original list of proposed bridges, a total of 55 bridges were listed. Before the arrival of mission, the Government of the Philippines requested to revise the number of Group 1 bridges from 30 to 32 and alternative of subject bridges of Group 2. Finally, 57 bridges were

accepted as the subject of the Basic Design Study. (Appendix 3-1; Original List of Proposed Bridges, Appendix 3-3; Letter of Request for Deletion).

CHAPTER 3

GENERAL CONDITIONS OF THE PROJECT AREA

CHAPTER 3

GENERAL CONDITIONS OF THE PROJECT AREA

3.1 Project Area

The bridges proposed for the Project (Phase III) are located in Region III, IV (IV-A and IV-B) and one portion of region I. (Refer to Figure 2.2-1). They are in Central Luzon neighboring Metro Manila, small islands, off Central Luson and on Palawan.

The number of Phase III Bridges proposed in each Region and Province are shown in Table 3.1-1.

TABLE 3.1-1 DISTRIBUTION OF PHASE III BRIDGES

Region	Proposed Bridges Group No.1	Group No.2	Total	Location of Proposed Bridges
I. Ilocos	0	1	1	Pangasinan
III. Central Luzon	1	1	2	Bataan
	2	1	3	Bulacan
	2	1	3	Pampanga
	0	1	1	Neva Ecija
	0	1	1	Tarlac
	1	0	1	Zambales
	6	5	11	No. of Bridges for Region III
IV-A South Tagalog	2	0	2	Cavite
	3	1	4	Quezon
	3	0	3	Batangas
	3	0	3	Aurora
	2	1	3	Laguna
	2	0	2	Rizal
	15	2	17	No. of Bridges for Region IV-A
IV-B South Tagalog	2	0	2	Palawan
	2	1	3	Romblon
	2	1	3	Marinduque
	0	0	0	Oriental Mindoro
	6	2	8	No. of Bridges for Region IV-B
Total	27	10	37	No. of Proposed Bridges

The location of each bridge is listed in Table 4.2-5 and 4.2-6 and shown on the location map.

3.2 Socio-Economic Conditions

(1) Land and Population

The Philippines consists of 7,100 islands that were formed by repeated organic movement and volcanic activities. The islands are divided into the three main groups of Luzon, Visayas and Mindanao. Luzon is the largest island and is located furthest north. Mindanao, the second largest island, is located furthest south. Visayas, composed of Samar, Leyte and other islands, is situated between Luzon and Mindanao.

The bridges proposed for the Project are located in Central Luzon and neighborhood small islands and Palawan Island. The area of the Region is shown below.

Name of Region	Area (km^2)	Remarks
Region III	18,230.8	Central Luzon Island
Region IV-A	19,468.2	Central Luzon Island Alabat Island
Region IV-B	27,456.0	Marinduque, Tablas, Palawan Island

The area of small islands are shown below.

Name of Island	Area (km^2)	Name of Province
Marinduque	959.2	Marinduque
Tablas	677.5	Romblon
Alabat	287.8	Quezon
Palawan	14,896.3	Palawan

In 1987, the total population of the Philippines was about 57 million with an average density of 190.9 persons per square kilometer.

Name of Region	Population (person)	Average Density (person/km^2)
III	5,720,409	314.2
IV-A	5,786,197	297.2
IV-B	1,692,387	61.6

(2) Nature

The Philippines is located in the tropics. The climate is affected by its geographical location and the different wind systems that prevails over the area. The condition of the climate has been described in terms of the characteristics of the distribution of rainfall received in a locality during different months of the year. There are four climate types in the Philippines. (Refer to Figure 1 of Appendix 9)

1) Climate

Given the fact that temperature differences in the Philippines are very small, while rainfall variations are large, climate is classified into four (4) types based solely on rainfall characteristics.

a) First Type : There are two pronounced seasons:

dry from November to April and wet for the rest of the year. The section between Sta. Rita and Sta. Fe in the North Study Section and the section between Calamba and Sariaya in the South Study Section are of this type.

The locations more than half of the 37 bridges it belong to this type excluding the bridges of 03.04 and 03.06 for Group I and of 03.13, 04.07a, 04.07b and 04.10b-2 for Group II.

b) Second Type : There is no dry season,and the maximum rain period is from November to January. The section from Pagbilao to Calauag in the South Study Section belongs to this type.

The locations of 04.04a and 04.06a for Group I, and 04.07a and 04.07b belong to this type.

c) Third Type : The seasons are not very pronounced: relatively dry from November to April and wet for the rest of the year. The maximum rain periods are not very pronounced, but the short dry season lasts only from one to three months. The section between Sta. Fe and Aritao in the North Study Section is of this type.

The location of 03.13 for Group 2 belong to this type.

d) Fourth Type : Rainfall is more or less evenly distributed throughout the year. The section between Sariaya and Pagbilao in the South Study Section is of this type.

The locations of 04.16a, 04.17a and 04.18a for Group I and 04.10b-z bridges for Group II belong to this type.

2) Rainfall

The average annual rainfall for the Philippines is 2,504.4 mm. Luzon has an annual average of 2,812.8 mm, Visayas 2,304.0 mm and Palawan 1,563.8 mm.

In Luzon, October has the highest average monthly rainfall with 451.3 mm, while February has the smallest average with 74.9 mm. August and October have the most rainy days with 20 days each (See Table 3.1-2).

3) Temperature

The mean annual temperature of the Philippines is 27.0 C. 1The average annual temperature in Luzon is 26.8 C, 27.3 C in Visayas and 27.4 C in Palawan. For the whole country in general, the hottest months are May with 28.2 C, June with 27.9 C and April with 27.2 C. The coldest months are January with 25.6 C, February with 25. C and December with 25.9 C.

TABLE 3.1-2 AVERAGE ANNUAL RAINFALL AND NO. OF RAINY DAYS: 1978-1984

Month	Philippines		Luzon	
	Normal Rainfall (mm)	No. of Rainy Days	Normal Rainfall (mm)	No. of Rainy Days
January	163.9	15	143.0	14
February	114.6	11	74.9	10
March	84.8	9	80.3	8
April	102.8	9	91.7	8
May	137.6	13	176.6	13
June	272.1	18	279.7	17
July	279.6	18	335.6	18
August	297.2	18	423.6	20
September	260.6	18	294.0	19
October	319.7	20	451.3	20
November	245.1	16	262.7	15
December	225.8	16	199.9	15

Source: PAGASA

(3) Society

In the Philippines, wide variations of economic performance in different regions can be observed. In 1985, the Gross National Product (GNP) registered 90.4 billion pesos, with contributions of 27.0 billion pesos (30%) by NCR (National Capital Region), 8.0 billion pesos (9%) by Region III (Central Luzon) and 12.9 billion pesos (14%) by Region IV (Southern Tagalog).

The regional poverty incidence in 1985 ranged from 44% of the families in NCR to 73% in Regions V (Bicol) and VI (Western Visayas).

The poverty incidence of the region of the project area is 44% in Region III (Contral Luzon) and 56% in Region IV (South Tagalog). (Refer to Appendix 9, Table 2.3)

(4) Economy

By industrial sector, the service sector consistently dominated the country's economy throughout the years from 1970 to 1985, contributing 38% to 42% to the national economy. Industry was next with contributions from 30% to 37%. Agriculture had the lowest contribution, ranging from 25% to 29% during the same period.

The economy of the country is basically agricultural and the total arable land of the Philippines is 1,333,258 hectares. In 1986, total agricultural crop production came to 28.5 million metric tons planted on 12.2 million hectares and valued at 77.9 million pesos. Of total production, about 80% was contributed by food crops made up of palay, corn and fruits, and only 20% by commercial crops led by coconuts and sugarcane.

The largest crop producing region of the country is Region XI (Southern Mindanao), contributing about 18% of the country's total crop production. The next largest crop producing regions are Central Mindanao (R-XII) and Western Visayas (R-VI), each contributing 12%.

The crop production of the regions of project area is Region III (Central Luzon) and Region IV (Southern Tagalog) each contributing about 8% and 9% respectively of the country's total crop production. (Refer to Appendix 9, Table 4)

(5) Infrastructure

As for infrastructure, transportation is described in Chapter 2 BACKGROUND OF THE PROJECT. Appendix 9, Table 7 shows road length by region, road classification and road surface type.

CHAPTER 4

DESCRIPTION OF THE PROJECT

CHAPTER 4

DESCRIPTION OF THE PROJECT

4.1 Objectives of the Project

The traffic conditions of the provinces in the Philippines do not work well to transport necessary materials and equipment inland especially by dump truck for development in the provinces and to load out the agricultural productions because there are few permanent bridges. Most of the existing bridges in the provinces are old and made of wood temporary. They are mostly spillway. Accordingly, the traffic sometimes stops particularily in the rainy season. These poor bridges disturb the utilization of existing road and also prevent the provinces from smooth development of the regions.

The bridges for Phase III are located on the main rural roads in the Philippines like Phase I and Phase II. And the objects are to improve the bridges need rapidly replacement to remove traffic problem on the rural roads, and not only to ensure fast, safe and smooth land transportation, but also to contribute to the socio-economic development of these areas.

In line with the Highway Development Program and in awareness of the conditions described above, priority is given to replacement of dilapidated and temporary bridges which diminish the efficiency of the highway network.

Under the Highway Development Program, both the Phase I and Phase II bridge construction Projects will be implemented in conformity with the following objectives:

(a) To provide basic transport facilities in rural areas.

(b) To enhance development and facilitate the effective delivery of socio-economic extension services to the communities served.

4.2 Review of Requested Contents of the Project

4.2.1 Proposed Bridges

The Five Year Comprehensive Bridge Reconstruction Program is to improve the total 264 bridges in five regions of the Philippines. The Government of The Philippines requested the Government of Japan the replacement of 57 bridges which locate in Region I, III and IV of the Philippines in the first year of the five year program.

The Government of the Philippines classified the 57 bridges into the Group 1 and Group 2. The Group 1 is consisted of 32 bridges which can be managed by the Philippines from the design and erection of steel girders up to construction. The Group II is composed of 25 bridges which the Government of Japan suggested to implement the design and the construction.

In the original proposal presented by the Philippine Government, a total of 55 bridges were indicated as shown in the Appendix 3-1 prepared by the Department of Public Works and Highways.

On November 1989, at the first meeting held between the two parties, the revised list of bridges, which numbers 57 bridges, was presented by the Philippine side to the Study Team. (Refer to Appendix 3-2)

The number of proposed bridges (original and revised) is shown in Table 4.2-1.

TABLE 4.2-1 NUMBERS OF PROPOSED BRIDGES BY REGION AND PROVINCE

REGION	PROVINCE	NUMBER OF BRIDGE		NUMBER OF GROUP	
		ORIGINAL	REVISED	1	2
I	Pangasinan	2	2	0	2
II	Bataan	3	3	2	1
	Bulacan	4	4	2	2
	Pampanga	4	4	2	2
	Nueva Ecija	2	2	2	0
	Tarlac	4	4	0	4
	Zambales	2	2	0	2
IV-A	Cavite	3	3	2	1
	Quezon	6	6	5	1
	Batangas	5	5	1	4
	Aurora	4	4	2	2
	Laguna	3	3	2	1
	Rizal	2	2	2	0
IV-B	Palawan	4	4	3	1
	Romblon	4	4	3	1
	Marinduque	2	4	4	0
	Oriental Mindoro	1	1	0	1
T O T A L		55	57	32	25

4.2.2 Selection of Bridges

The mission has selected the reasonable 37 bridges as Japan Grand Aid from the proposed 57 bridges for Phase III based on the basic data which had been released by the Philippine side. Those bridges became the object of basic design for Phase III.

The basic data of the proposed bridges and selection are presented in Appendix 4.

The criteria of selection for the proposed bridges are as follows.

1) Urgency degree of bridge's replacement.
2) Population of the influential area caused by bridge replacement.
3) Relating condition between the side and main cities.
4) Condition of the bridges on access roads.
5) Feature improvement plan for the route.
6) The Extent of damage to existing bridges.
7) Construction to be finished with in one year.
8) Beneficial impact
9) Data necessary for detailed design almost completed except for geological information.
10) Others

The following below is the reasons that the 20 bridges were excluded as in the program.

- Bridges that were regarded to provide a few beneficial impact, though Construction Cost is high and Bridge length is very long.

  9 bridges

- Bridge whose damages are a little bit and whose utility still in safety.

  6 bridges

- Bridges whose access road condition is not matched to the site, ie. inland transport of the construction materials and equipment is difficult.

  2 bridges

- Proposed bridges are pedestrian/footway, so that not so important to construct new bridges

  2 bridges

- Bridges that has already being constructed by the Government of the Philippines and the Government requested the Japan to cancel the construction.

  1 bridge