Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

FEASIBILITY STUDY
ON
REHABILITATION AND MAINTENANCE
OF
BRIDGES ALONG ARTERIAL ROADS

FINAL REPORT
VOLUME I
(SUMMARY)

JUNE, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of the Republic of the Philippines, the Japanese Government decided to conduct the Feasibility Study on Rehabilitation and Maintenance of Bridges along Arterial Roads and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines a survey team headed by Mr. Hisashi OHSHIMA, Nippon Koei Co., Ltd., comprising members from Nippon Koei Co., Ltd., and ALMEC Corporation from December 1, 1987 to March 25, 1989.

The team held discussions with the officials concerned of the Government of the Republic 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.

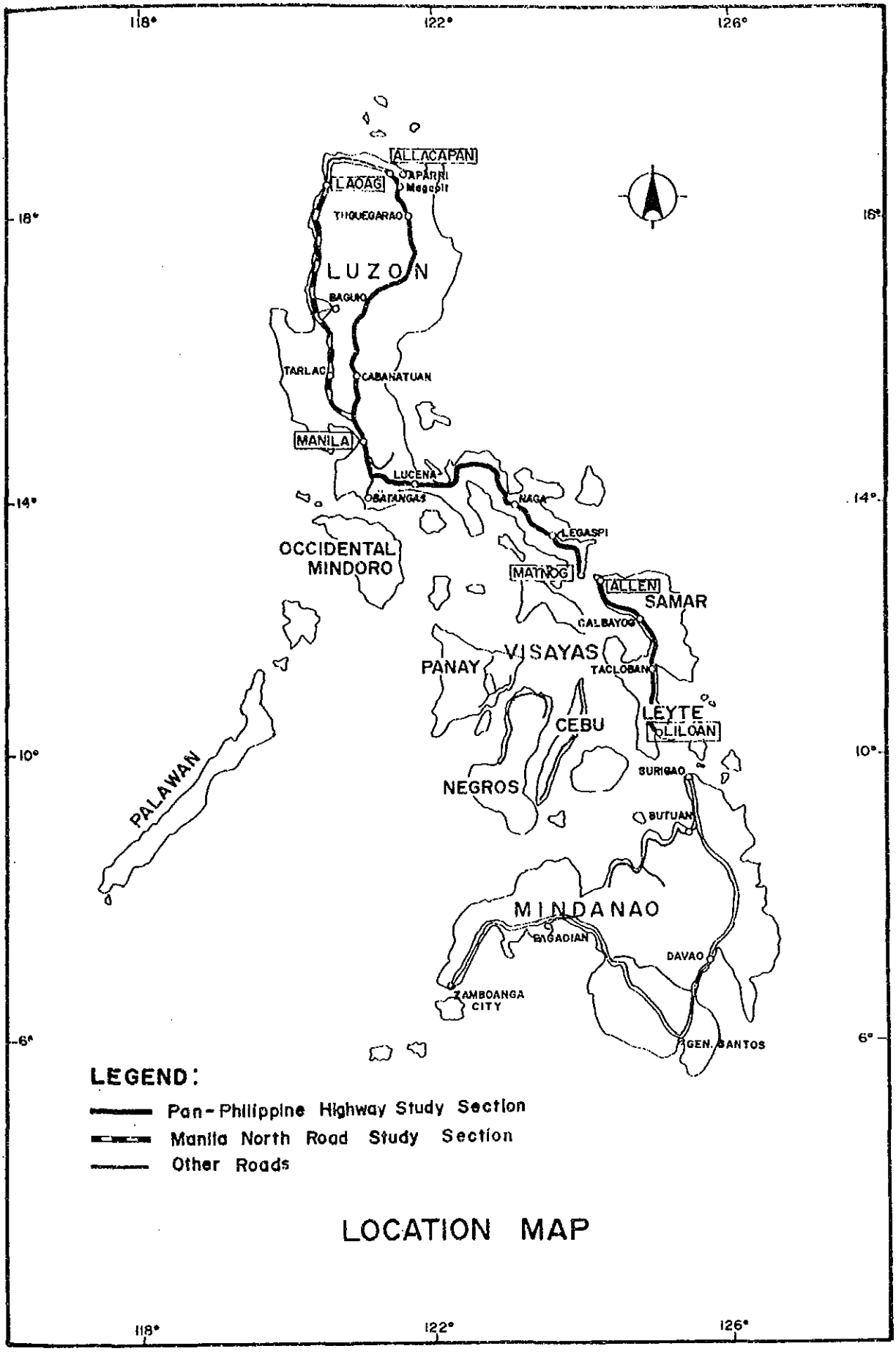
I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

June, 1989

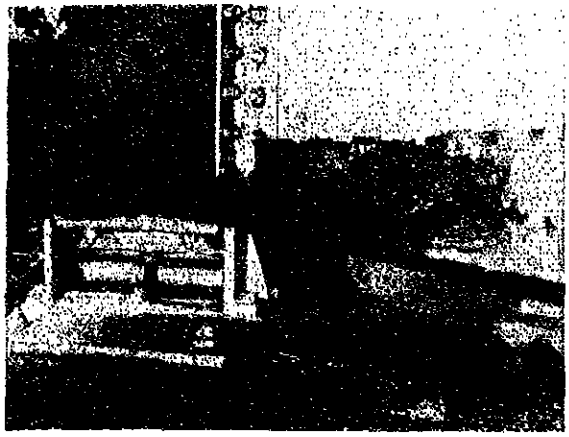
Kensuke Yanagiya

President

Japan International Cooperation Agency

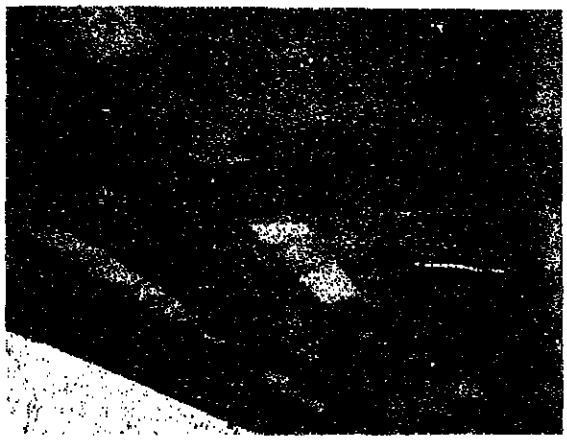


LOCATION MAP



MAJOR MEMBERS :

Section loss of the steel member



STEEL STRUCTURE :

Serious rust of main beam (S - I - B)

DECK SLAB :

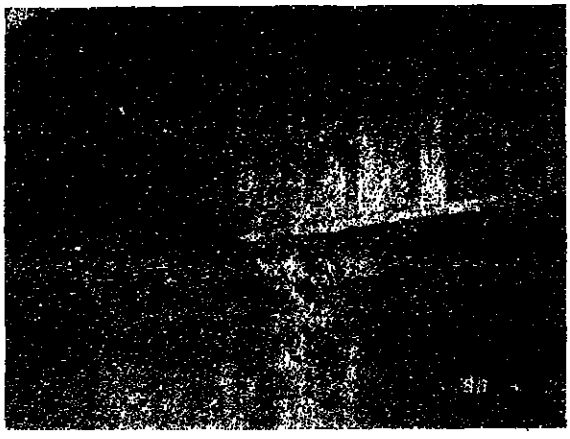
Serious cracks on the concrete deck slab of (S - I - B)

CONCRETE BEAM :

Seriously spalled concrete beam at the midspan of the bridge

CONCRETE BEAM :

Exposed reinforcing bars of the beam (R. C. D. G.)



SUBSTRUCTURE :

Spalling at pier cap due to the movement of concrete beam

FOUNDATION :

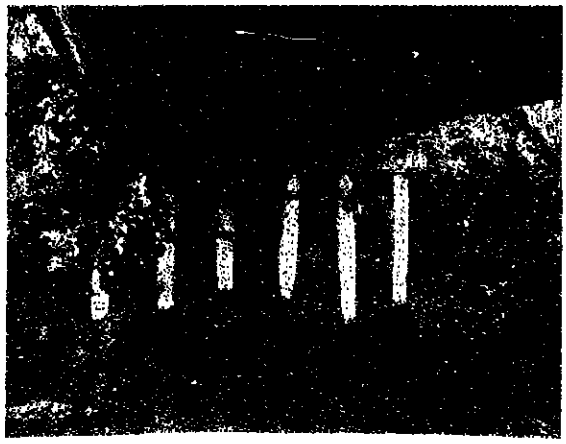
Crushed top of the concrete pile foundation

FOUNDATION :

Exposed pile foundation due to local scouring of the river bed

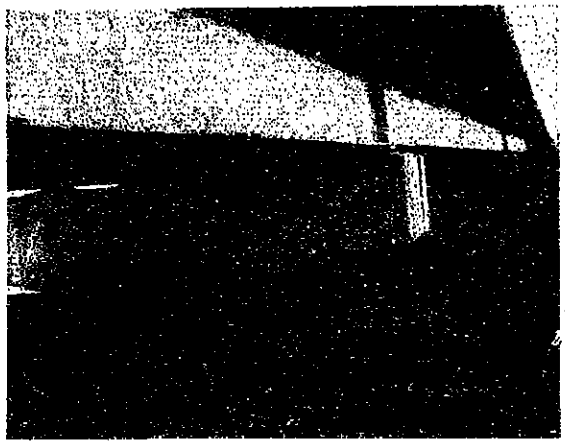
RIVER BANK :

Washed - out river bank under construction



ABUTMENT :

Exposed abutment after washing away of slope protection

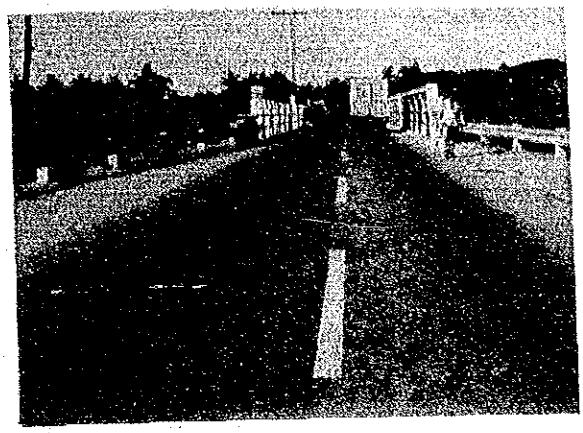


PIERS :

Hidden columns of piers due to river sedimentation

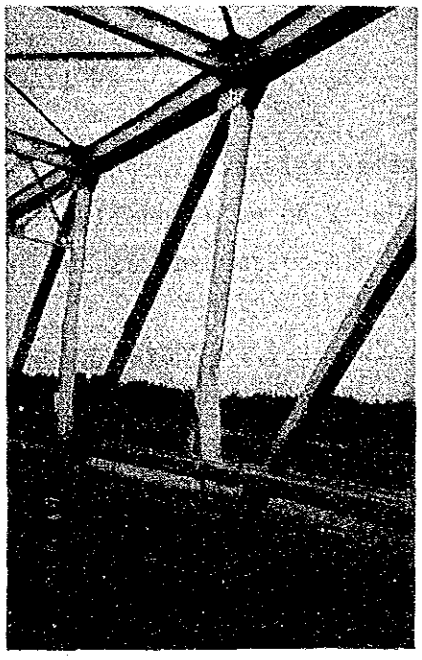
RIVER CURRENT :

River current is flowing in parallel with the bridge axis



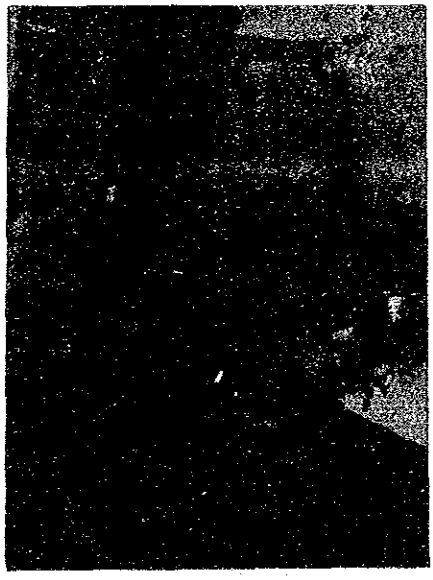
BRIDGE WIDTH :

Inadequate bridge width
specifically for trusses



BRIDGE WIDTH :

Damaged by collision of vehicles due to
narrow width of the bridge



SHOE :

Pulled out anchor bolt from
concrete bed

CONTENTS

1. INTRODUCTION

1.1 Project Background

The Pan-Philippine Highway and the Manila North Road are important arteries in the highway network of the Republic of the Philippines. These highways link the islands of Luzon, Samar, Leyte and Mindanao. Restoration of the said highways was carried out from 1946 to 1948 with a financial assistance from the U.S. Public Works Department. The upgrading of the entire length of the highway including bridges was carried out from 1969 to 1979 with a financial assistance from the Government of Japan (GOJ) through the Overseas Economic Cooperation Fund (OECF).

However, the bridge structures have deteriorated rapidly due to the increase in traffic volume, heavy loads and low design standard. The steel structures such as I-beams and trusses are already rusty or heavily corroded due to inadequate maintenance. The river banks are eroded and recently a bridge collapsed due to the movement of the pier by river flood. In such situation, the Government of the Republic of the Philippines (GOP) made a request for technical assistance to GOJ.

In response to the request of GOP, GOJ decided to conduct a feasibility study on the REHABILITATION AND MAINTENANCE OF BRIDGES ALONG THE ARTERIAL ROADS and exchanged the Notes Verbals with GOP concerning the implementation of the Study.

Based on the Notes Verbals, the Japan International Cooperation Agency (JICA) organized a Japanese Preliminary Study Mission which was dispatched to the Philippines from April 20 to 29, 1987 for discussions on and signing the Implementing Arrangement. After a series of discussions, the Implementing Arrangement between JICA and the Department of Public Works and Highways (DPWH) was agreed and signed. Subsequently, JICA organized a team of experts to carry out the feasibility study, and dispatched it to the Republic of the Philippines.

2. OBJECTIVES AND RESULTS OF THE STUDY

2.1 Objectives

The objectives of the study are:

(1) To establish the bridge rehabilitation program,

(2) To establish the bridge data base, and

(3) To prepare an approach on bridge inspection and maintenance report.

2.2 Results of the Study

(1) Existing and Rehabilitation Bridges

Section	No. of Exist. Bridges	Rehabilitation Bridges			
		Reconst.	Replacement	Repair	Total
(P.P.H)					
Manila - Allacapan	185	2	1	10	13
Matnog - Manila	239	0	9	13	22
Liloan - Allen	161	2	1	1	4
(M.N.)					
Manila - Laoag	157	8	4	1	13
Total	742	12	15	25	52

(2) Project Cost (1988 Price)

a) Foreign Currency Component 612,958 X 10^3 pesos (68%)

b) Local Currency Component (incl.Tax) 294,318 X 10^3 pesos (32%)

c) Total 907,276 X 10^3 pesos (100%)

(3) Economic Feasibility

a) Internal Rate of Return (IRR) 55.69%

b) Benefit Cost Ratio (B/C) 11.18

c) Net Present Value (NPV) 6,141,815 X 10^3 Pesos

(4) Tentative Rehabilitation Schedule

Phase	Number of Br.	Start of Const.	Completion year
Phase - I	36	July 1991	June 1994
Phase - II	16	July 1992	June 1994

3. RECOMMENDATIONS

3.1 Importance of Rehabilitation of the Existing Bridges

Restoration works of the Manila North Road and Pan-Philippine Highway were conducted during the 1940s and 1970s. The bridge structures on the above road and highway have deteriorated and were damaged by various causes such as increased traffic volume, heavy loads, low design standards, inadequate maintenance and river flood. Recently, deterioration and damages of existing bridges become rapidly serious. Thus, without any urgent rehabilitation actions to avoid further aggravation of such deterioration and damages, rehabilitation works will become increasingly costly. Moreover, traffic interruptions owing to bridge collapse might seriously hamper economic and community activities. Therefore, rehabilitation works on bridges along arterial roads in the Republic of the Philippines is essential and shall be given high priority. It is clear that the rehabilitation of existing bridges is highly worthy and will provide great impetus to the economic development of the Philippines.

3.2 For Implementation of Rehabilitation Program

The rehabilitation program for bridges along the Manila North Road and the Pan-Philippine Highway, involves the reconstruction, replacement of superstructure and repair of 52 bridges. The total project cost will amount to 907,276 x 10^3 Pesos apportioned into foreign portion of 612,958 x 10^3, local portion of 203,687 x 10^3 and tax of 90,631 x 10^3. For the effective and prompt implementation of urgent rehabilitation works, a phasing strategy is adopted for implementation based on the priority results of economic evaluation and on the size of construction implementation.

(1) The economic indicators were calculated by individual bridge, by route section and by region. The internal rates of return (IRRs) of the bridges to be reconstructed are low due to their high construction costs. The bridges to be reconstructed, however, are given high priority because of their narrow width and low loading

capacity. Moreover, their structures have seriously deteriorated and damaged widely on the bridge structures. Those bridges may cause traffic interruptions and consequently seriously obstruct normal social and economic activities.

(2) To implement effectively the rehabilitation program, priority must be considered according to the results of the economic evaluation, phased and package systems based on the construction size, existence of detouring roads and traffic volume. The high priority for rehabilitation should be given to the sections of Manila to Matnog, Manila to Bayombong on the Pan-Philippine Highway and Manila to Bauang on the Manila North Road.

(3) The desirable overall project implementation period has been scheduled as 4 years and 6 months from the detailed engineering studies to the completion of the construction. The detailed engineering period will be one and half (1.5) years and the overall construction period three (3) years.

3.3 For Future Inspection and Maintenance

Inspection and maintenance of the existing bridges including the 52 bridges in the rehabilitation program is necessary and important tasks of DPWH. Application of the results such as the Inspection and Maintenance Report and bridge data base is recommended to enhance effectiveness of management by DPWH. Establishment of special team and program of educating staff for the specialists are also recommended.

(1) The guidelines and recommendations on measures to be applied for the existing bridges have been treated in the Inspection and Maintenance Report covering the inspection, maintenance and the executing organization. Since the report has been carefully prepared considering the present situation in the Philippines, the application of the study results in the report is expected to greatly enhance the effectiveness of the DPWH's management.

(2) Bridge data base was computerized for the 742 existing bridges as an easy-retrieval system and its utilization is highly recommended for the effective performance of inspection and maintenance by DPWH.

(3) It is recommended that a special inspection team be established to evaluate bridge damages and to judge the necessity of rehabilitation with up-to-date techniques of the bridge inspection. For early establishment of the special inspection team, an education program (lectures by a inspection specialist, seminars or practical on-the-job training) for staff participating in the special inspection team should be implemented as soon as possible. Procurement of inspection equipment is also recommended to improve the level of inspection technique in parallel with the establishment of the special team.

4. OUTLINE OF THE STUDY

4.1 Summary of Work Activities

The Study was carried out for the existing 742 bridges (total road length 2,134 km) along the Pan-Philippine Highway from Aparri in Luzon to Liloan in Southern Leyte and the Manila North Road. The work activities of the Study are diagrammed in the flow chart (WORK ACTIVITY FLOW OF THE STUDY) and were mainly undertaken as follows:

PHASE-1 (November 1987 to March 1988)

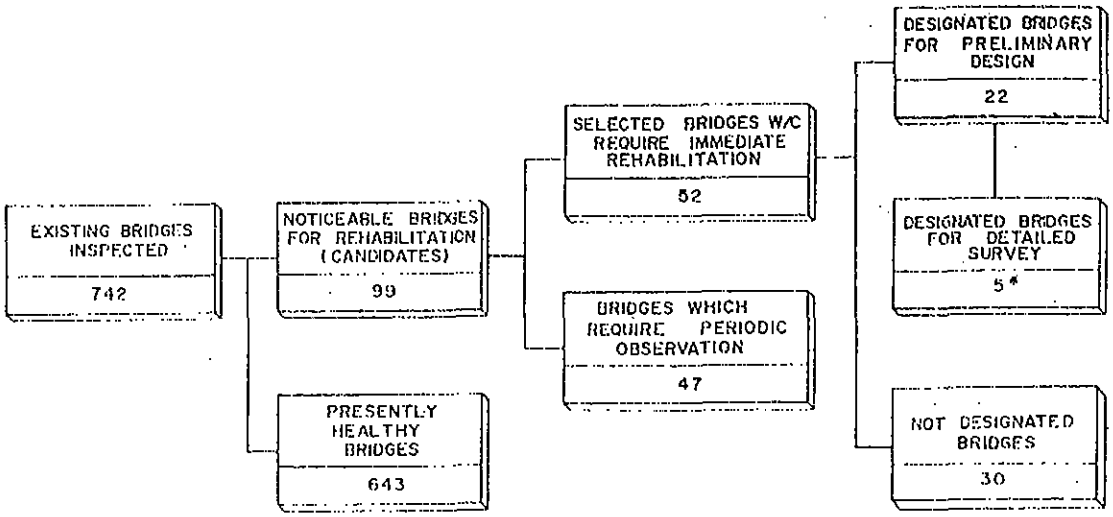
Major activities carried out during Phase-I mainly include visual inspection at the field and selection of representative bridges for the Phase 2 Study through initial evaluation and classification. Consequently, the numbers of bridges for the individual study carried out in the Phase-II were determined as mentioned below.

- Results of initial evaluation showed 99 damaged and 643 healthy bridges (those under normal condition).

- Of the 99 bridges for rehabilitation 52 were selected as "requiring urgent rehabilitation" and 47 as "requiring periodical observation".

- Out of the above 52 bridges, the 22 bridges requiring preliminary design were selected.

- 5 bridges were selected for detailed survey to obtain necessary data for the preliminary design.



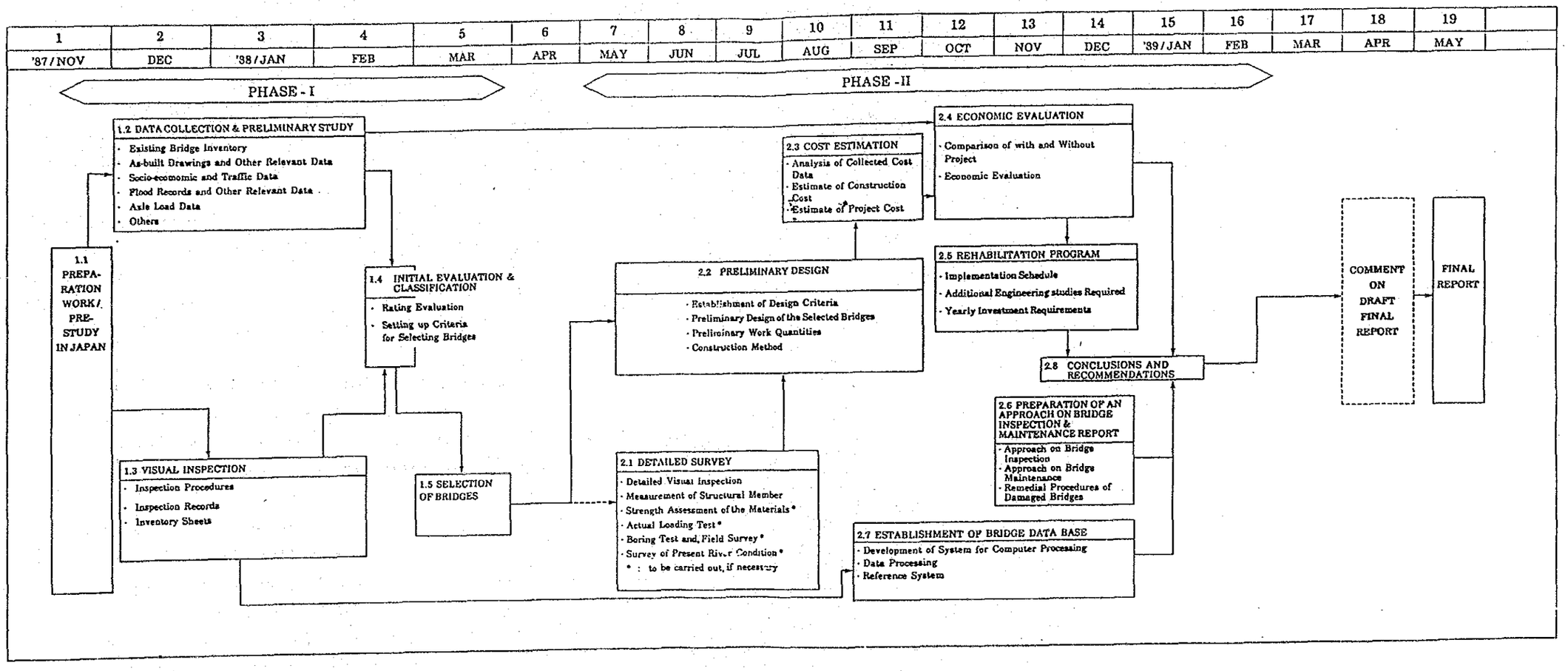
Note: Figures correspond to number of bridges
*: One from 99 bridges

PHASE-2 (May 1988 to Feb 1989)

Based on the selections of bridges in Phase-I, the Study in Phase-II was carried out; 1) to prepare a preliminary design in consideration of the results of detailed survey, 2) to estimate project cost for bridges to be urgently rehabilitated, 3) to evaluate rehabilitation projects from the economic, engineering and social points of view, 4) to formulate a rehabilitation program for the 52 bridges to be urgently rehabilitated and 5) to formulate recommendation on the implementation of bridge rehabilitation. Approach on Bridge Inspection and Maintenance Report and establishment of bridge data base were prepared through the complication of bridge data, ideas and method used in visual inspection, detailed surveys and preliminary design.

The subsequent sections show present in detail procedures and results of the Study.

WORK ACTIVITY FLOW OF THE STUDY



4.2 Visual Inspection

A visual inspection was carried out for all the existing bridges along the Pan-Philippine Highway, excluding Mindanao and the Manila North Road, to confirm the actual situation of the existing bridges such as damages on deck slab, the structural members of the bridges, scouring around the pier and abutment foundations. The collected bridge data were used for the bridge data base and initial evaluation after being arranged and examined by the JICA study team.

4.2.1 Data Collection

All the available and relevant data were collected with the cooperation of DPWH. The study team reviewed and initially analyzed the said data. The major data items are categorized below:

- Existing Bridge Inventory Data and As-Built Drawings
- Flood Records and Other Relevant Data
- Socio-economic Data
- Traffic Data
- Other Existing Data (Climate, Cost Data, Topographic Maps, etc.)

Most of data were obtained from the relevant organizations, the library of PMO-FS and other data centers through the assistance of the counterparts, while some were gathered during the visual inspection. The data came mainly from the following organizations and offices:

- National Economic and Development Authority (NEDA)
- National Irrigation Administration (NIA)
- National Institute of Climatology (NIC)
- Philippine Bureau of Coast and Geodetic Survey (BCGS)
- Department of Public Works and Highways (DPWH)
- Philippine Bureau of Mines and Geo-Sciences (PBMG)

4.2.2 Features of Existing Bridges

(1) Features of Existing Bridges on Manila-Laoag Section

The Manila-Laoag section of the Manila North Road traverses two regions Region III on the southern portion and Region I on the northern portion. The southern portion is mainly composed of flat terrain while that of the northern portion is mountainous. Most of the road on the northern portion is located near the coast facing the China Sea. Big rivers are found only on the southern portion, so it is in this part that long span bridges are concentrated. The RCDG Bridge is the most common type used on the Manila North Road due to the fact that the Northern portion is of mountainous terrain and its being easy to construct by using materials and manpower.

(2) Features of Existing Bridges on Manila-Allacapan Section

This road section is a part of the Pan-Philippine Highway. It traverses a flat terrain on the southern portion extending to the Metro Manila area and the mountainous area on the northern portion. Big rivers like the Magat river and Cagayan River cross this road section, thus, long span bridges are used. Compared to other road sections of the Pan-Philippine Highway, this section has the longest aggregate length of Trusses.

(3) Features of Existing Bridges on Matong-Manila Section

The Matnog-Manila road section of the Pan-Philippine Highway runs in the southern most part of Luzon to San Pedro, Laguna. The topography of the northern portion is flat while that of the southern portion is mountainous. A portion of this highway in the northern part passes along the coast of Quezon Province facing the Pacific Ocean. Many small rivers abound in the Matnog-Manila road section, that is why short span bridges like the RCDG and SIB type are used here. It is in this part of the Pan-Philippine Highway that bridges of RCDG type are concentrated.

(4) Features of Existing Bridges on Liloan-Allen Section

This section of the Pan-Philippine Highway runs in the southern most part of Leyte to Allen, the northern most part of Samar Island. It traverses two big islands, Samar and Leyte, which are connected by the Marcos Bridge spanning 2.2 kms. The southern portion of this section which is the Island of Leyte has a topography of mountainous terrain as well as that of the northern portion, the Island of Samar. Most of the highways in the northern part of Samar is located near the coast. It is in this section that bridges of SIB type are concentrated unlike the other road sections where the RCDG type is most commonly used.

4.2.3 Classification of Existing Bridges

As the result of visual inspection, the total number of the existing bridges was revealed to be 742 instead of 731 which is shown in original scope of the study defined in Section 1.2. The 742 bridges are classified according to their number, size, type, year of construction, and the degree of deterioration and/or damages. The following shows the number of bridges by bridge classification.

(1) The location and number of bridges on each road section are briefly described below.

NAME OF ROAD SECTION	REGION	NO. OF BRIDGE
MANILA - LAOAG	III	48
(Manila North Road)	I	109
MANILA - ALLACAPAN	III	62
(Pan-Philippine Highway North)	II	123
MATNOG - MANILA	V	158
(Pan-Philippine Highway South)	IV-A	81
LILOAN - ALLEN	VIII	161
(Pan-Philippine Highway Samar/Leyte)		
TOTAL		742

(2) Number of bridge by width

Roadway width (m)	Number of Bridges (Bridges)	Roadway width (m)	Number of Bridges (Bridges)
Less 5.0	0	8.5	157
5.0	0	9.0	44
5.5	1	9.5	19
6.0	18	10.0	14
6.5	9	10.5	5
7.0	26	11.0	2
7.5	75	11.5	3
8.0	358	12.0	11
		Unknown	0
Total			742

(3) Types and number of existing bridges

Type of Bridge	No. of Bridges
1) Steel Bridges	
Truss	34
Pony	7
S.I.B.	247
Others	0
Sub-total	288
2) Concrete Bridges	
R.C.D.G.	311
Conc. Slab	69
P.C.D.G.	30
Arch	31
Sub-total	441
3) Other types	13
Total	742

(4) Number of bridges by year of construction

Years	No. of Bridges
1901 - 1925	32
1926 - 1940	34
1941 - 1955	89
1956 - 1970	132
1971	281
Unknown	174
Total	742

4.2.4 Initial Evaluation

For the assessment of the existing bridges surveyed by visual inspection, an initial evaluation was carried out by bridge engineer's judgment based on criteria related to the degree of structural deterioration, including potential dangers brought by river condition, i.e. bank/slope erosion, local scouring and sedimentation, etc. As a result, the bridges were rated as A (Urgent Replacement or repair), B (Need Repair) or C (Maintenance only).

According to the initial evaluation based on the above criteria, the 742 bridges were individually rated as A, B or C according to the rating of bridge condition based on the degree of structural deterioration and damages. The numbers of bridges by rated categories are as follows:

Rating Categories		No. of Bridges	
A	} A + B	49	} 99
B		50	
C		643	
Actual No. Inspected		742	

The bridges rated as A and B (99 bridges) are defined as noticeable bridges and screened as bridges to be urgently rehabilitated.

4.3 Selection of Bridges for Rehabilitation

The noticeable bridges (99 bridges) judged to have serious deterioration and damages in the initial evaluation were considered as candidate bridges for rehabilitation. To establish the bridge rehabilitation program, the selection of the bridges to be urgently rehabilitated was carried out of these noticeable bridges based on the technical rating, traffic and socio-economic circumstances. The technical rating was categorized into; 1) corrosion/collision of major member, 2) concrete beam crack/spalling, 3) deck slab/spalling, 4) substructure/foundation, 5) bank washing away/erosion, 6) slope protection erosion, 7) clearance shortage, 8) river current incoincidence, 9) inadequate bridge width, 10) approach road and 11) others. The criteria of traffic and socio-economic circumstances consist of 1) bridges along roads where traffic volume is considerably high and with inadequate width 2) bridges located within the range of no probable detouring 3) bridges located within the area where the population of the respective province along the road is more than 300,000 persons 4) bridges located within the area where the number of infrastructure facilities is more than 10 for each province.

The 99 noticeable bridges were rated by technical and socio-economic criteria as shown in the following tables (SELECTING BRIDGE FOR REHABILITATION (1/5) - (5/5)).

SELECTING OF BRIDGES FOR REHABILITATION (1/5)

MANILA NORTH ROAD
(MANILA - LAOAG)

TYPES OF DETERIORATION & DAMAGES

NO.	BR. NO.	BRIDGE NAME	BRIDGE TYPE	BR. LENGTH	STRUCTURE (1) Corrosion / Collision of Major Members	STRUCTURE (2) Concrete Beam Crack / Spalling	STRUCTURE (3) Deck Slab Crack / Spalling	STRUCTURE (4) Substructure / Foundation	RIVER (5) Bank Washing Away / Erosion	RIVER (6) Slope Protection Erosion	TRAFFIC (7) Clearance Shortage	TRAFFIC (8) River Current Incoincident	(9) Inadequate Bridge Width	(10) Approach Road	(11) Others	SOCIO-ECONOMIC Technical Rating	SOCIO-ECONOMIC Traffic Volume	SOCIO-ECONOMIC Detouring	SOCIO-ECONOMIC Population	SOCIO-ECONOMIC Facilities	SELECTED BR. 52	SELECTED BR. 22
1	3	MARILAO	RCDG	60.00	B	A									A	*		*			O	
2	14	LABANGAN I	S-I-B	100.00		B	A								A*	*	*	*			O	O
3	22	SULIPAN	PONY/TRUSS	328.50	B						A				A	*	*	*			O	
4	31	PULONG BULO	RCDG	32.00			B								B	*	*	*				
5	37	SAN FELIPE	RC-SLAB S-I-B	36.00		B									B	*	*	*				
6	48	PLARIDEL	TRUSS	634.40		E									B	*	*		*		O	
7	53	TABUSOK	RCDG	36.00					B		B				B	*			*			
8	54	TAGAMUSING	RCDG	40.38	A	A	A		A		A				A*	*			*		O	O
9	58	BUED	PONY/TRUSS RCDG/S-I-B	500.70	B					A	A				A*	*			*		O	O
10	65	LOMBOY	RCDG	45.00		A		B							A	*			*		O	O
11	77	BAUANG I	PONY	221.40	B						A		A		A	*	*	*			O	O
12	77-1	BAUANG II	PONY	187.20	B						A		A		A	*	*	*			O	
13	84	BORORO	RCDG	176.00		B									B	*			*			
14	102	CANAYON	S-I-B	35.00	B			B							B		*					
15	104	STA. CRUZ I	S-I-B/RCDG	260.50					B		A				A*		*				O	
16	113	LANGLANGKA I	RCDG	14.00		A		B							A		*				O	
17	120	STA. MARIA	TRUSS	298.20							A				A*		*				O	
18	121	SAN ANTONIO	RCDG	60.00					B						B*		*					
19	123	TULAY	RCDG	37.00						B					B		*					
20	137	PARSUA	RCDG	36.00							B				B*		*					
21	140	OSMENA	RCDG/S-I-B	179.00		B									B		*					
22	142	SAPILANG	S-I-B	29.70	B			B							B		*					
23	148	TIPCAL	RCDG	35.00		A		A							A				*		O	

Note : RCDG : Reinforced Concrete Deck Girder
PCDG : Prestressed Concrete Deck Girder
S-I-B : Steel I-Beam
TRUSS : Steel Through Truss
PONY : Steel Pony Truss
R.C.SLAB : Reinforced Concrete Slab

(SOCIO-ECONOMIC)

LEGEND	TRAFFIC (VEHICLES)	DETOUR	POPULATION (PERSONS)
BLANK	<2000	PROBABLE	<300,000
*	>2000	NONE	>300,000

SELECTING OF BRIDGES FOR REHABILITATION (2/5)

PAN-PHILIPPINE HIGHWAY
(MANILA-ALLACAPAN)

TYPES OF DETERIORATION & DAMAGES

NO.	BR. NO.	BRIDGE NAME	BRIDGE TYPE	BR. LENGTH	STRUCTURE (1) Corrosion / Collision of Major Members	STRUCTURE (2) Concrete Beam Crack / Spalling	STRUCTURE (3) Deck Slab Crack / Spalling	STRUCTURE (4) Substructure / Foundation	RIVER (5) Bank Washing Away / Erosion	RIVER (6) Slope Protection Erosion	RIVER (7) Clearance Shortage	RIVER (8) River Current Incoincident	TRAFFIC (9) Inadequate Bridge Width	TRAFFIC (10) Approach Road	TRAFFIC (11) Others	SOCIO-ECONOMIC Technical Rating	SOCIO-ECONOMIC Traffic Volume	SOCIO-ECONOMIC Detouring	SOCIO-ECONOMIC Population	SOCIO-ECONOMIC Facilities	SELECTED BR. S2	SELECTED BR. 22
24	3	PLARIDEL-PULIAN	S-I-B	171.20				A							A	*			*		○	
25	14	SAN ROQUE	RCDG	84.00		A									A	*			*		○	
26	16	ANYATAM I	RCDG R.C. SLAB	24.00		B	B								B	*			*			
27	31	MALIMBA	R.C. SLAB	30.40		B									B	*			*			
28	41	GEN. LUNA	PCDG	611.00		B		B							B	*			*			
29	43	SICSICAN	TRUSS	150.00			A								A	*			*		○	○
30	71	INDIANA	S-I-B PONY	98.99			B						B		B*	*	*				○	○
31	73	BATU	TRUSS	350.00			B			A					A*	*	*				○	○
32	86	NAMANPARAN I	RCDG	45.00		A									A	*	*				○	
33	86-1	NAMANPARAN II	R.C. SLAB	6.00			B								B	*	*					
34	89	SAN LUIS	RCDG	24.00		A									A		*				○	
35	93	DUBINAN	RCDG	21.00		B	B								B	*	*		*			
36	103	DEL PILAR	RCDG	9.50			B								B	*			*			
37	105	MINANTE	S-I-B	10.20			B								B	*			*			
38	109	NAGUILIAN	S-I-B TRUSS	675.00			A								A*				*		○	○
39	113	MALALAM	S-I-B TRUSS	475.40			A								A*				*		○	○
40	126	BALASIG	TRUSS	75.00						A					A*				*		○	
41	129	SAN PABLO	S-I-B TRUSS	279.00			A								A				*		○	
42	139	PINACANAUAN	S-I-B TRUSS	383.40			A	A							A*		*		*		○	○
43	148	MALABBAC	RCDG PONY	59.70			B								B		*		*			
44	154	PARED	PONY/RCDG TRUSS	193.10	A		A			A					A*		*		*		○	○

Note : RCDG : Reinforced Concrete Deck Girder
PCDG : Prestressed Concrete Deck Girder
S-I-B : Steel I-Beam
TRUSS : Steel Through Truss
PONY : Steel Pony Truss
R.C. SLAB : Reinforced Concrete Slab

(SOCIO-ECONOMIC)

LEGEND	LEGEND (VEHICLES)	DETOUR	POPULATION (PERSONS)
BLANK	<2000	PROBABLE	<300,000
*	>2000	NONE	>300,000

SELECTING OF BRIDGES FOR REHABILITATION (3/5)

PAN-PHILIPPINE HIGHWAY
(MATNOG-MANILA)

TYPES OF DETERIORATION & DAMAGES

NO.	BR. NO.	BRIDGE NAME	BRIDGE TYPE	BR. LENGTH	STRUCTURE (1) Corrosion / Collision of Major Members	STRUCTURE (2) Concrete Beam Crack / Spalling	STRUCTURE (3) Deck Slab Crack / Spalling	STRUCTURE (4) Substructure / Foundation	RIVER (5) Bank Washing Away / Erosion	RIVER (6) Slope Protection Erosion	RIVER (7) Clearance Shortage	RIVER (8) River Current Incoincident	TRAFFIC (9) Inadequate Bridge Width	TRAFFIC (10) Approach Road	(11) Others	SOCIO-ECONOMIC Technical Rating	SOCIO-ECONOMIC Traffic Volume	SOCIO-ECONOMIC Detouring	SOCIO-ECONOMIC Population	SOCIO-ECONOMIC Facilities	SELECTED BR. 52	SELECTED BR. 22
45	14	RANGAS	S-I-B	61.80	B			B							B	*						
46	18	HIMAOYON	S-I-B	18.70	B										B	*						
47	19	SUSI (RIZAL)	RC SLAB	12.00		A	A								A	*					○	○
48	22	ABUYOG	RCDG	11.90		B									B	*						
49	25	CAWAYAN	PCDG	155.00					B						B*	*						
50	43	GUINOBATAN	S-I-B	55.60					A						A	*			*		○	
51	70	MABULO	TRUSS S-I-B	111.40				B							B	*		*	*			
52	75	SAN FERNANDO	S-I-B	21.80			A								A	*		*	*		○	
53	76	PAMUKID	S-I-B	22.50	B		B								B	*		*	*		○	
54	77	SAN ISIDRO	S-I-B	22.50			A								A	*		*	*		○	
55	78	SAN GABRIEL	RC SLAB	19.50			A	B							A	*		*	*		○	○
56	79	PAHOHO	RCDG	12.00			A								A	*		*	*		○	
57	80	TINIGUIBAN	RCDG	19.90		B	A								A	*		*	*		○	
58	82	SGT MATIAS	RCDG	15.00			A								A	*		*	*		○	
59	86	NAUBOD I	S-I-B	15.00	B		A								A	*		*	*		○	
60	93	CULOY CULOY	RCDG	18.00			B								B		*	*	*			
61	94	ABOBO	RCDG	22.30			B								B		*	*	*			
62	97	SIPANG	RCDG	22.40		B	B								B			*	*			
63	99	SOOK	S-I-B	33.30			A								A			*	*		○	
64	133	POTOT	S-I-B	24.0	B		B								B							
65	143	KANAPAWAN	S-I-B	45.60			A								A		*				○	
66	152	MINASAG	TRUSS	49.60	B		B								B		*					
67	154	BASIAD	TRUSS	58.50	A		A								A		*				○	
68	168	OVERHEAD	RCDG	20.10		B	B							B	B		*	*	*			

Note : RCDG : Reinforced Concrete Deck Girder
PCDG : Prestressed Concrete Deck Girder
S-I-B : Steel I-Beam
TRUSS : Steel Through Truss
PONY : Steel Pony Truss
R.C. SLAB : Reinforced Concrete Slab

(SOCIO-ECONOMIC)

LEGEND	TRAFFIC (VEHICLES)	DETOUR	POPULATION (PERSONS)
BLANK	<2000	PROBABLE	<300,000
*	>2000	NONE	>300,000

SELECTING OF BRIDGES FOR REHABILITATION (4/5)

MANILA NORTH ROAD
(MATNOG - MANILA)

TYPES OF DETERIORATION & DAMAGES

NO.	BR. NO.	BRIDGE NAME	BRIDGE TYPE	BR. LENGTH	STRUCTURE (1) Corrosion / Collision of Major Members	STRUCTURE (2) Concrete Beam Crack / Spalling	STRUCTURE (3) Deck Slab Crack / Spalling	STRUCTURE (4) Substructure / Foundation	RIVER (5) Bank Washing Away / Erosion	RIVER (6) Siope Protection Erosion	TRAFFIC (7) Clearance Shortage	TRAFFIC (8) River Current Incoincident	(9) Inadequate Bridge Width	(10) Approach Road	(11) Others	SOCIO - ECONOMIC Technical Rating	SOCIO - ECONOMIC Traffic Volume	SOCIO - ECONOMIC Detouring	SOCIO - ECONOMIC Population	SOCIO - ECONOMIC Facilities	SELECTED BR. 52	SELECTED BR. 22
69	173	GUMACA	RCDG	46.20		A	A							A			*	*	*	○	
70	181	TALABA	RCDG	23.20		A								A		*		*	*	○	
71	188	BINAHAAN	RCDG	48.00		B	A							A		*	*	*	*	○	○
72	190	FALSABANGON	RCDG	57.00		A	A							A		*	*	*	*	○	
73	194	DOMOCLONG I	PCDG	25.00		B								B		*		*	*		
74	206	LAGNAS II	RC-SLAB	20.00			A							A		*	*	*	*	○	
75	208	STO. CRISTO	RCDG	36.00		A								A		*	*	*	*	○	○
76	220	MAGAPONG	PONY	25.70	A		B				A			A		*		*	*	○	○
77	223	BIGA	S-I-B	46.00	B		A		A					A		*		*		○	
78	227	SAN CRISTOBAL	RCDG / TRUSS	73.60	A		A	B						A		*	*	*		○	○

Note : RCDG : Reinforced Concrete Deck Girder
PCDG : Prestressed Concrete Deck Girder
S-I-B : Steel I-Beam
TRUSS : Steel Through Truss
PONY : Steel Pony Truss
R.C. SLAB : Reinforced Concrete Slab

(SOCIO - ECONOMIC)

LEGEND	TRAFFIC (VEHICLES)	DETOUR	POPULATION (PERSONS)
BLANK	<2000	PROBABLE	<300,000
*	>2000	NONE	>300,000

SELECTING OF BRIDGES FOR REHABILITATION (5/5)

PAN-PHILIPPINE HIGHWAYS
(LILOAN-ALLEN)

TYPES OF DETERIORATION & DAMAGES

NO.	BR. NO.	BRIDGE NAME	BRIDGE TYPE	BR. LENGTH	STRUCTURE (1) Corrosion / Collision of Major Members	(2) Concrete Beam Crack / Spalling	(3) Deck Slab Crack / Spalling	(4) Substructure / Foundation	RIVER (5) Bank Washing Away / Erosion	(6) Slope Protection Erosion	TRAFFIC (7) Clearance Shortage	(8) River Current Incoincident	(9) Inadequate Bridge Width	(10) Approach Road	(11) Others	SOCIO-ECONOMIC Technical Rating	Traffic Volume	Detouring	Population	Facilities	SELECTED BR. S2	SELECTED BR. 22
79	4	ILAG	S-I-B	68.20	B										B		*					
80	35	LAYOG	TRUSS	148.00	B										B		*		*			
81	41	MILUSIG	S-I-B	62.40			B								B		*		*			
82	65	TELEGRAFO II	RC SLAB	7.25			B		B						B	*	*		*			
83	88	SILAGA	RCDG	56.00							B				B		*	*				
84	104	TINAGO	RCDG	10.00				B	B						B		*	*				
85	106	BATO	S-I-B	15.70	B										B		*	*				
86	107	BURAY	RC-SLAB	6.00		B									B		*	*				
87	109	JIAGONG	RC-SLAB	74.80		A	A	B							A*		*	*			O	O
88	111	ANTIAO	RCDG	36.00		B									B		*	*				
89	114	SAPINIT I	S-I-B	32.00					D						B		*	*				
90	119	NACOBE	S-I-B	22.00	B						B				B		*	*				
91	120	HINOGBONGAN	S-I-B	21.80			B	A	A						A*		*	*			O	O
92	122	ILO	S-I-B	31.00	B										B		*	*				
93	127	CARAYMAN	S-I-B	15.60	B				B						B		*	*				
94	133	TINAMBACAN	S-I-B	25.00	B										B		*	*				
95	135	MALAJOG	S-I-B	31.00	B						B				B		*	*				
96	145	MANOK-MANOK	S-I-B	37.40	B										B		*	*				
97	146	CALAGNIPAO	S-I-B	55.90	B		B	B							B		*	*				
98	160	JUBASAN II	PONY	44.60	A		A								A		*				O	O
99	161	JUBASAN I	TRUSS	74.00	A										A		*				O	O

Note : RCDG : Reinforced Concrete Deck Girder
PCDG : Prestressed Concrete Deck Girder
S-I-B : Steel I-Beam
TRUSS : Steel Through Truss
PONY : Steel Pony Truss
R.C. SLAB : Reinforced Concrete Slab

(SOCIO-ECONOMIC)

LEGEND	TRAFFIC (VEHICLES)	DETOUR	POPULATION (PERSONS)
BLANK	<2000	PROBABLE	<300,000
*	>2000	NONE	>300,000

4.4. Bridge Detailed Survey

The bridge detailed survey was conducted to obtain data on the actual condition of the existing structure, data of geotechnical condition and topographic map at the representative bridge sites. The survey consisted mainly of structural survey, topographic survey, geotechnical survey, full scale loading tests and river hydrological survey. The structural survey was carried out on the measurement of structural sizes to be used for analysis of the loading capacity of the bridges and non-destructive test to assess their physical, chemical, mechanical properties. The topographic and geotechnical surveys were also carried out to produce topographic maps of complicate terrain and to get accurate knowledge on bearing strata for respective bridge foundation. A full scale loading test was conducted to compare the results of the loading test with that of calculation formula, aiming at collecting information to select rehabilitation methods. The river hydrological survey was conducted to analyze hydrological conditions and to design river training works for bridge rehabilitation.

The structural survey was conducted on the following five (5) representative bridges. Four (4) bridges was selected from twenty-two (22) bridges and one (1) bridge from the ninety-nine (99) bridges mentioned above. They are:

1) Labangan I Bridge in Calumpit, Bulacan,
2) Bauang I Bridge in Bauang, La Union,
3) Antayam I Bridge in San Ildefonso, Bulacan,
4) Sto. Cristo Bridge in Sariaya, Quezon, and
5) San. Cristobal Bridge in Calamba, Laguna

The topographic survey was conducted on five (5) typical bridges. Four (4) bridges was selected from the twenty-two (22) bridges and one (1) bridge from the ninety-nine (99) bridges mentioned above. The five (5) bridges are:

1) Labangan I Bridge in Calumpit, Bulacan,
2) Bauang I Bridge in Bauang, La Union,

3) Antayam I Bridge in San Ildefonso, Bulacan,
4) Sto. Cristo Bridge in Sariaya, Quezon, and
5) San Cristobal Bridge in Calamba, Laguna

Among the twenty two (22) bridges selected for preliminary design, geotechnical surveys were conducted at the following five bridge locations.

1) Indiana Bridge in Aritao, Nueva Viscaya,
2) Pinacanauan Bridge in Tuguegarao, Cagayan,
3) Bauang I Bridge in Bauang, La Union
4) Bued Bridge in Sison, Pangasinan, and
5) Labangan I Bridge in Calumpit, Bulacan

A full scale loading test was conducted at San Cristobal Bridge. The river hydrological survey was also conducted on the 19 bridges judged to be requiring urgent rehabilitation.

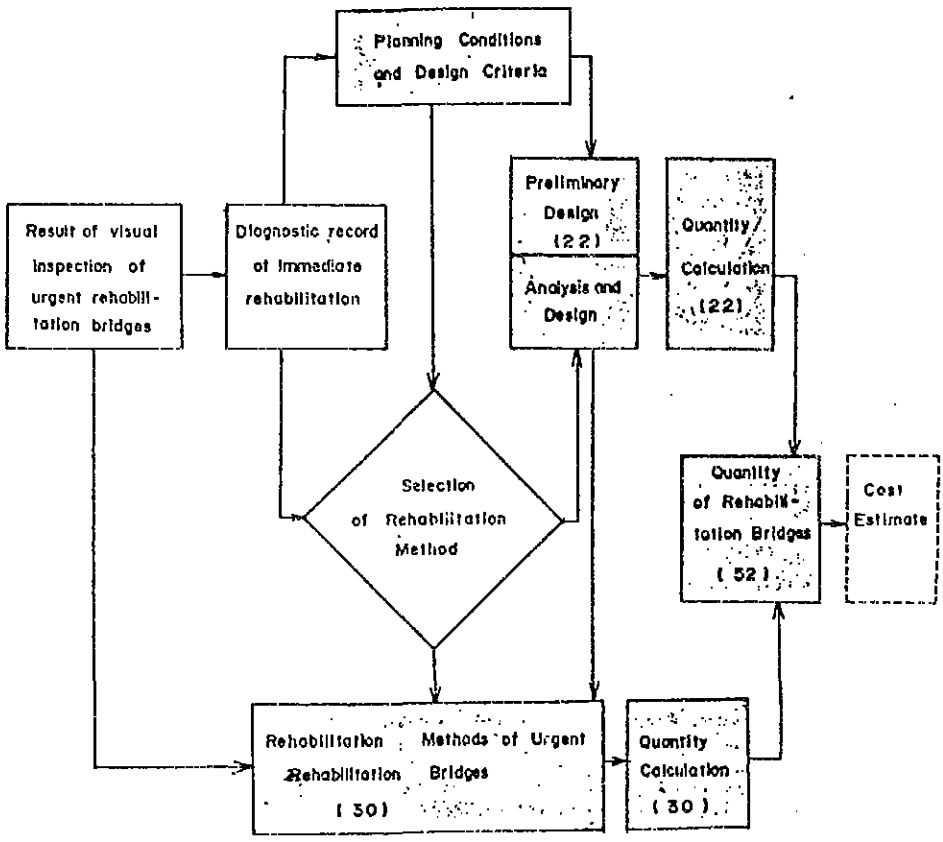
4.5 Preliminary Design

The preliminary design, covering the 22 bridges selected out of the 52 bridges to be urgently rehabilitated, was carried out based on the output of the previous detailed survey. The preliminary design covers reinforcement of the superstructures and substructures and replacement and reconstruction of the selected bridges, including river training. The preliminary design involves the determination of classification and extent of deterioration and damages, comparison of alternatives of rehabilitation and repair methods, structural design based on the results of visual inspection, working out of rehabilitation methods for the existing bridges and estimation of preliminary quantities. Based on the results of visual inspection, detailed structural survey and the planning conditions, the preliminary design was carried out for 22 bridges. The results of the preliminary design of the 22 bridges were applied to the other 30 bridges which also require urgent rehabilitation among the 52 bridges. The comparative designs were conducted to determine the type and size of the bridges.

The representative rehabilitation works adopted in the preliminary design were categorized into three classifications, i.e. reconstruction, replacement of superstructure and repair. Furthermore, the 14 rehabilitation methods of repair were elaborated.

Work quantities were computed based on the drawings of preliminary design of the 22 bridges. The quantities of the other urgent 30 bridges were also computed based on the laid out drawings which are prepared by applying the results of design of the 22 bridges.

FLOW CHART DIAGRAM OF PROCEDURE OF PRELIMINARY DESIGN



( ) Figure in the bracket shows number of bridges

4.5.1 Selection of Rehabilitation Methods

The classification of rehabilitation on the 22 bridges was judged in consideration of 1) bridge width, 2) permissible loading capacity and 3) extent of deterioration and damages. The classifications of rehabilitation are certainly applicable to the remaining 30 bridges which require urgent rehabilitation through their likeness of bridge types. Judgment on reconstruction, replacement of superstructure and repair of bridges is made through the criteria established with the three conditions mentioned above. Based on the Study Team's determinations considering the causes of problem and the features of bridge maintenance in the Philippines, further study was carried out to select the most suitable rehabilitation method to be applied to the existing bridges.

The representative rehabilitation methods are categolized as below and presented in detail, in the form of Table (REHABILITATION METHODS (1/4) - (4/4)).

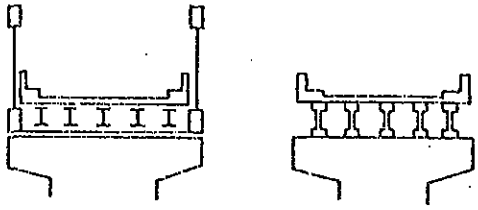
Classification	Rehabilitation Methods
(1) Reconstruction	(1) Reconstruction
(2) Replacement of Superstructure	(2) Replacement of Superstructure
(3) Repair	(3) Replacement of Deck Slab
	(4) Reinforcement of Deck Slab
	(5) Additional Sidewalk
	(6) Widening of Girder Bridge
	(7) Extension of Approach Span
	(8) Reinforcing Concrete Beam of RCDG
	(9) Link Slab
	(10) Widening of Pier Cap/Bearing Bed
	(11) Reinforcement of Substructure
	(12) Protection of Pier Foundation
	(13) Slope Protection and River Bank Protection
	(14) Foot Protection
	(15) River Bed Protection
	(16) Groyne

REHABILITATION METHODS (1/4)

REHABILITATION METHODS	SECTIONS	
	BEFORE ACTIONS	AFTER ACTIONS

1.) Reconstraction

The new construction of bridge covering superstructure, sub-structure and foundation is considered due to the serious conditions from viewpointsof functional and physical requirement.

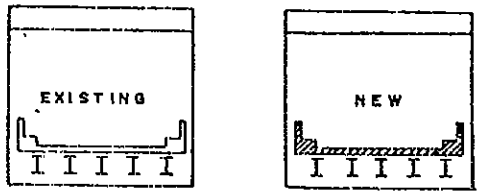


2.) Replacement of Superstructure

The reconstruction of the super-structure portion is considered due to the inadequate bridge width and serious damages on the wide range of bridge structure.

3.) Replacement of Deck Slab.

Concrete deck slab is replaced due to its serious deteriora-tion and damages.



4.) Reinforcement of Deck Slab.

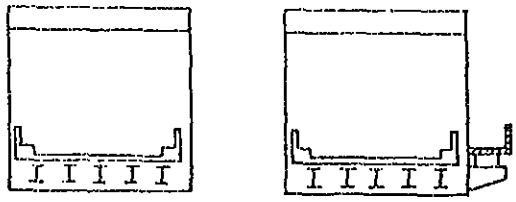
The existing concrete deck slab is sustaind with additional stringer at the middle of the existing deck span, and cross beam is reinforced, if necessary.

REHABILITATION METHODS (2/4)

REHABILITATION METHODS	SECTIONS	
	BEFORE ACTIONS	AFTER ACTIONS

5.) Additional Sidewalk

Additional sidewalk is provided to the existing bridge (Steel Truss) because of shortage of the required width.

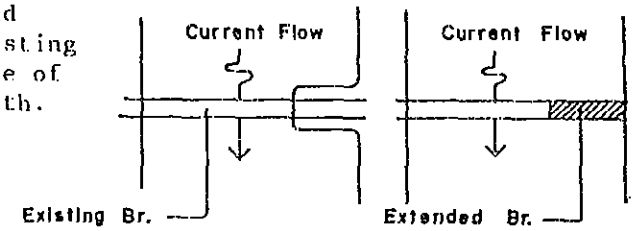


6.) Widening of Girder Bridge

Additional girders are provided at both sides of the existing bridge in case the roadway width is short of the requirement.

7.) Extension of Approach Span

New bridge spans are provided for the extension of the existing bridge as a side span because of the requirement of river width.



8.) Reinforcing Concrete Beam of RCDG.

The deteriorated or damage concrete beam and/or deck slab is reinforced by jacketing repair method. Shear cracks on the beam are repaired with additional rebars and jacketing concrete.

REHABILITATION METHODS (3/4)

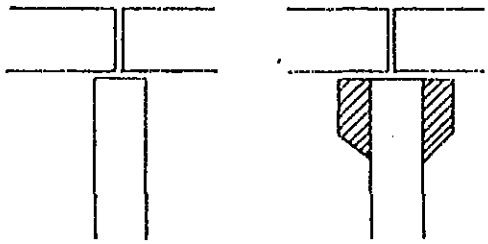
REHABILITATION METHODS	SECTIONS	
	BEFORE ACTIONS	AFTER ACTIONS

9.) Link Slab

Link slab is installed at the approach portion of the existing bridge where it severely settles down because of soft ground and other intricated conditions.

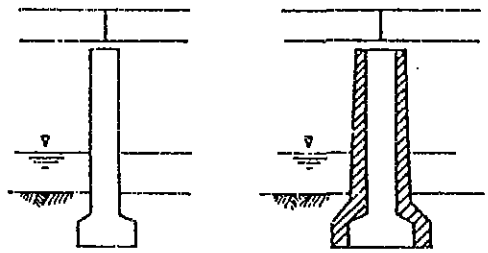
10.) Widening Pier Cap/ Bearing Bed

Pier cap and bearing bed are widened in case that reconstruction of superstructure is planned or the existing cap and bed spacing is too narrow to sustain RCDG bridge sufficiently.



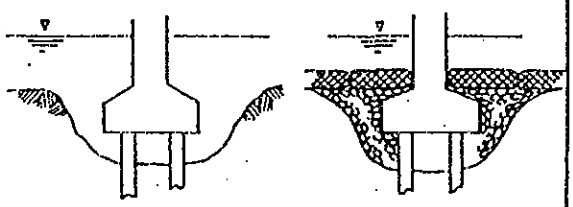
11.) Reinforcement of Substructure

Substructure is reinforced since its structural size is too short to sustain the superstructure and/or damage is serious.



12.) Protection of Pier Foundation

Foundation is protected in suitable manners and with materials to prevent scour from developing around pier foundation.

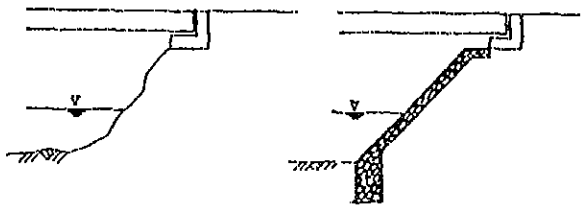


REHABILITATION METHODS (4/4)

REHABILITATION METHODS	SECTIONS	
	BEFORE ACTIONS	AFTER ACTIONS

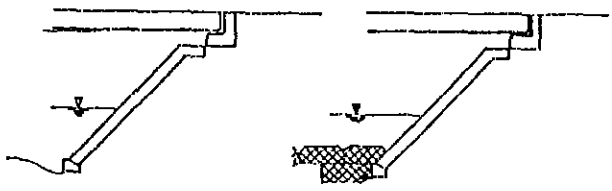
13) Slope Protection / River Bank

The protection is put in front of the abutment and on the riverbank to prevent erosion by river current.



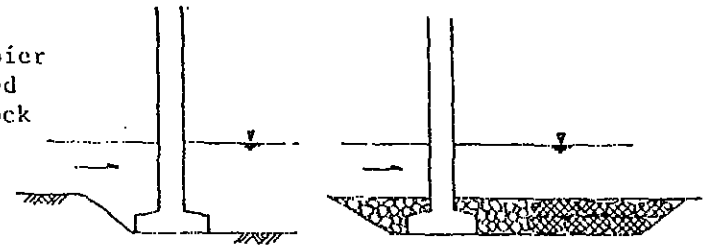
14) Foot Protection

The foot portion of bank slope is protected from erosion by providing gabion or concrete block mattress.



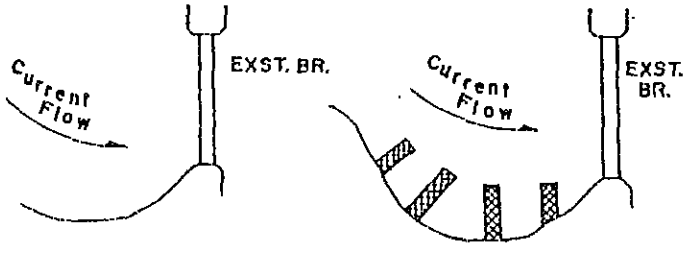
15) River Bed Protection

The riverbed around the pier and abutment are protected with gabion, concrete block and pitching stone.



16) Groyne

Stone masonry is provided to control river current flow at the place where current flow is rushing or curving sharply.



4.6 Cost Estimation

Costs estimation was made for the 52 bridges requiring urgent rehabilitation. First, a unit price was set up by analyzing the collected cost data. Based on this above unit price and the results of discussion with DPWH about the cost analysis and cost estimation system, the rehabilitation and maintenance costs were estimated for the bridges requiring urgent rehabilitation.

The detailed cost estimation is shown in APPENDICES, SUMMARY OF CONSTRUCTION COST ESTIMATE. The project cost is estimated for the selected rehabilitation bridges and proposed in the preliminary design on the basis of the following assumption and conditions.

(1) The cost is estimated at the price level as of the beginning of August 1988..

(2) The cost is calculated in terms of the Philippine peso including foreign and local component and taxes.

(3) The exchange rate of currency is US $1.0 = ₱21.05, ₱1.0 = ¥6.28 as of the beginning of August 1988 of the Central Bank of the Philippines.

(4) Price escalation rate is assumed to be 5% per annum for both foreign and local components.

(5) The project will be implemented by DPWH with employment of engineering consultants and the construction works will be carried out by the contract system through international competitive tenders.

The project cost for the reconstruction or rehabilitation of bridges is estimated at ₱907,276,000 consisting of ₱612,958,000 (68%) for foreign component, ₱203,687,000 (22%) for local component and ₱90,631,000 (10%) for taxes respectively.

The project cost consists of the construction cost, engineering and government administration, and acquisition and compensation cost, and contingency. The project cost is summarized below.

The construction cost constituting of the main part of the project cost is estimated at ₱624,044,000 consisting of ₱426,405,000 (68%) for foreign component, ₱135,235,000 (22%) for local component and ₱62,404,000 (10%) for taxes respectively.

Unit: Peso x 10^3

Description	Components			
	Amount	Foreign	Local	Taxes
1. Construction Cost	624,044	426,405	135,235	62,404
2. Engineering and Government Administration (Design and Supervision)	93,607	63,961	20,285	9,361
3. Land acquisition cost	8,170	____	7,430	740
Sub-total	725,821	490,366	162,950	72,505
4. Contingencies				
Physical contingency	72,582	49,037	16,295	7,250
Price contingency	108,873	73,555	24,442	10,876
Sub-total	181,455	122,592	40,737	18,126
5. Grand total	907,276	612,958	203,687	90,631

4.7 Economic Evaluation

The major purpose of the economic evaluation is to determine the economic viability of the proposed 52 bridges and their priority ranking for individual bridges and bridge combinations by road link for the implementation program.

Techniques commonly developed in highway feasibility studies were applied for the economic evaluation of the bridge rehabilitation study.

4.7.1 Economic costs and benefits for economic evaluation

Economic costs were calculated from financial costs at the base year (1988) price level with shadow pricing for each proposed rehabilitation bridge. The shadow pricing was carried out for the foreign exchange costs components and unskilled labour costs.

The benefits stream over the 20 year project life was estimated for each proposed rehabilitation bridges. These benefits were derived from the following cost savings:

- Risk of bridge unserviceability (calculated as elimination of traffic diversion costs)
- Increase of loading capacity (calculated as reduction of vehicle operation costs for trucks)
- Reduction of bridge unserviceability caused by flood (calculated as elimination of traffic diversion costs)
- Maintenance cost savings
- Residual Value

The major benefits were derived from the risk of bridge unserviceability. They were calculated as savings of traffic diversion costs on the detour route or construction costs of detour bridges with the probability of bridge unserviceability. For this purpose, the road links and detour routes were determined for each rehabilitation bridge.

Beside the above quantifiable benefits, important non-quantifiable social benefits such as improvement of public security would accrue to the surrounding area, considering the case in which the bridge is unusable without project. However, these non-quantifiable benefits were not calculated because of lack of reliable method of calculation.

4.7.2 Result of Economic Evaluation

Three economic indicators were calculated for the 52 rehabilitation bridges and for the alternative combinations of bridges; Internal Rate of Return (IRR), Net Present Value (NPV) and Benefit/Cost Ratio. Ranking for rehabilitation priority was evaluated base on the Internal Rate of Return. The Internal Rate of Return on individual rehabilitation bridges varies widely between 22.5 % and 572 %. Generally, the rehabilitation project shows a high IRR. The IRRs of the reconstruction bridges are low ranging between 22.5 % and 82.1 % due to the large construction costs. However, these reconstruction bridges are not necessarily ranked as low priority, because most of them have a large amount of Net Present Value which is equivalent to the net benefits of project. Moreover, these bridges will have enormous non-quantifiable benefits. For that reason, these reconstruction bridges should be given higher priority in the 52 rehabilitation bridges.

The economic evaluation of the alternative combinations of bridges was carried out based on the cost/benefits analysis of the road links; by road section, by route and by region. The IRRs on road sections indicate that Section 4, 7 and 9 on the Pan-Philippine Highway have a high value of IRR, while Section 6 and 10 on the Pan-Philippine Highway far from Manila have a low value.

As the total project of the 52 rehabilitation bridges has an IRR of 55.7 %, it is considered to be feasible as a project for improvement of infrastructure.

ECONOMIC EVALUATION FOR ROAD SECTION

ROAD	ROAD SECTION (BRIDGE)	No.of Bridges	Cost	IRR	RANKING
MANILA NORTH ROAD	1. MARILAO (3) - BAUANG II (77-1)	9	358,693	46.3	6
	2. STA. CRUZ I -(104) sta. maria (120)	3	42,143	42.0	8
	3. TIPCAL (148)	1	2,081	50.0	5
PAN-PHILIPPINE HIGHWAY NORTH	4. PLARIDEL DPULIAN (3) - SICSICAN (43)	3	26,076	122.9	2
	5. INDIANA (71) - NAGUILIAN (109)	5	63,069	44.2	7
	6. MALALAM (113) - PARED (154)	5	44,671	29.8	10
P.P.H. SOUTH	7. SUJE (19) - NAUBOD I (86)	10	8,508	411.5	1
	8. SOOK (99) - PALSABANGON (190)	7	13,093	100.0	4
	9. LAGNAS II (206) - SAN CRISTOBAL (227)	5	10,056	122.1	3
P.P.H. LEYTE	10. JIABONG (109) - JUBASAN I (161)	4	35,098	34.8	9

PRIORITY RANKING OF INDIVIDUAL REHABILITATION BRIDGES

IRR Rank	Rehab. Bridge Seq.No.of 52 Bridges	Bridge Number	Bridge Name	Rehab. Method	Economic Cost P'000	IRR %	NPV P'000	
1	1	3	MARILAO	Replace	1,181	572.1	142,128	
2	15	14	SAN ROQUE	Repair	730	475.6	165,892	
3	44	206	LAGNAS 2	Repair	197	381.4	64,659	
4	16	43	SICSICAN	Repair	3,995	367.7	373,240	
5	35	82	SGT. MATIAS	Repair	197	317.4	29,743	
6	20	89	SAN LUIS	Repair	313	305.3	36,123	
7	33	79	PAHOHO	Repair	266	289.5	29,705	
8	36	86	NAUBOD 1	Repair	950	247.8	58,793	
9	38	143	KANAPAWAN	Repair	1,552	243.5	67,841	
10	28	43	GUINOBATAN	Repair	880	223.4	67,171	
11	30	76	PAMKID	Repair	1,100	222.9	58,706	
12	31	77	SAN ISIDRO	Repair	1,679	173.7	58,381	
13	29	75	SAN FERNAND	Repair	1,691	173.1	58,374	
14	39	154	BASIRD	Repair	2,733	172.0	71,365	
15	47	223	BIGA	Repair	961	153.5	40,808	
16	46	220	MAGAPONG	Replace	3,011	120.2	48,929	
17	7	65	LOMBOY	Replace	973	100.0	37,968	
18	19	86	NAMANPARAN 1	Replace	4,887	100.0	69,557	
19	32	78	SAN GABRIEL	Replace	1,656	98.2	35,215	
20	34	80	TINIGUIBAN	Replace	1,668	97.9	35,209	
21	37	99	SOOK	Repair	892	92.8	31,259	
22	40	173	GUMACA	Replace	2,559	88.2	60,266	
23	45	208	STO. CRISTO	Replace	2,941	88.0	80,552	
24	41	181	TALABA	Replace	2,652	86.9	60,215	
25	5	54	TAGAMUSING	Reconst	15,205	82.1	236,316	*
26	11	113	LANGLANGKA 1	Replace	2,606	79.5	40,650	
27	42	188	BINAHAAN	Replace	4,065	67.1	57,708	
28	43	190	PALSABANGON	Replace	4,285	65.3	57,582	
29	9	77-1	BAUANG 2	Reconst	44,687	61.0	421,075	*
30	4	48	PLARIDEL	Repair	36,581	54.2	273,554	
31	10	104	STA. CRUS 1	Reconst	18,679	50.0	122,888	*
32	13	148	TIPCAL	Replace	3,509	50.0	28,115	
33	14	3	PLARIDEL PULIA	Repair	28,232	48.9	190,505	
34	3	22	SULIPAN	Reconst	122,852	48.4	607,005	*
35	23	126	BALASIG	Repair	4,007	47.7	31,524	
36	8	77	BAUANG 1	Reconst	72,468	46.4	386,476	*
37	27	19	SUJE	Replace	3,138	46.1	18,617	
38	17	71	INDIANA	Reconst	26,287	45.9	105,907	*
39	48	227	SAN CRISTBAL	Repair	5,975	38.9	21,469	
40	12	120	STA. MARRIA	Reconst	33,570	37.2	102,668	*
41	18	73	BATU	Repair	31,428	37.2	86,445	
42	2	14	LABANGAN 1	Reconst	74,286	37.1	186,355	*
43	21	109	NAGUILIAN	Repair	29,761	36.5	83,191	
44	52	161	JUBASAN 1	Reconst	19,408	35.4	44,772	**
45	50	120	HINOGBONGAN	Repair	2,061	34.4	6,456	
46	24	129	SANPABLO	Repair	14,614	32.4	34,530	
47	51	160	JUBASAN 2	Replace	9,669	30.7	25,835	
48	49	109	JIABONG	Reconst	19,315	30.0	27,295	**
49	22	113	MALALAN	Repair	9,021	29.6	16,298	
50	26	154	PARED	Reconst	22,129	26.8	23,247	**
51	25	139	PINACANAUAN	Repair	14,683	24.1	15,379	
52	6	58	BUED	Reconst	119,969	22.2	81,193	**

NOTE; * ; RECONSTRUCTION BRIDGE HAVING NPV OVER 100 MILLION PESOS
** ; RECONSTRUCTION BRIDGE HAVING NPV UNDER 100 MILLION PESOS

4.8 Rehabilitation Program

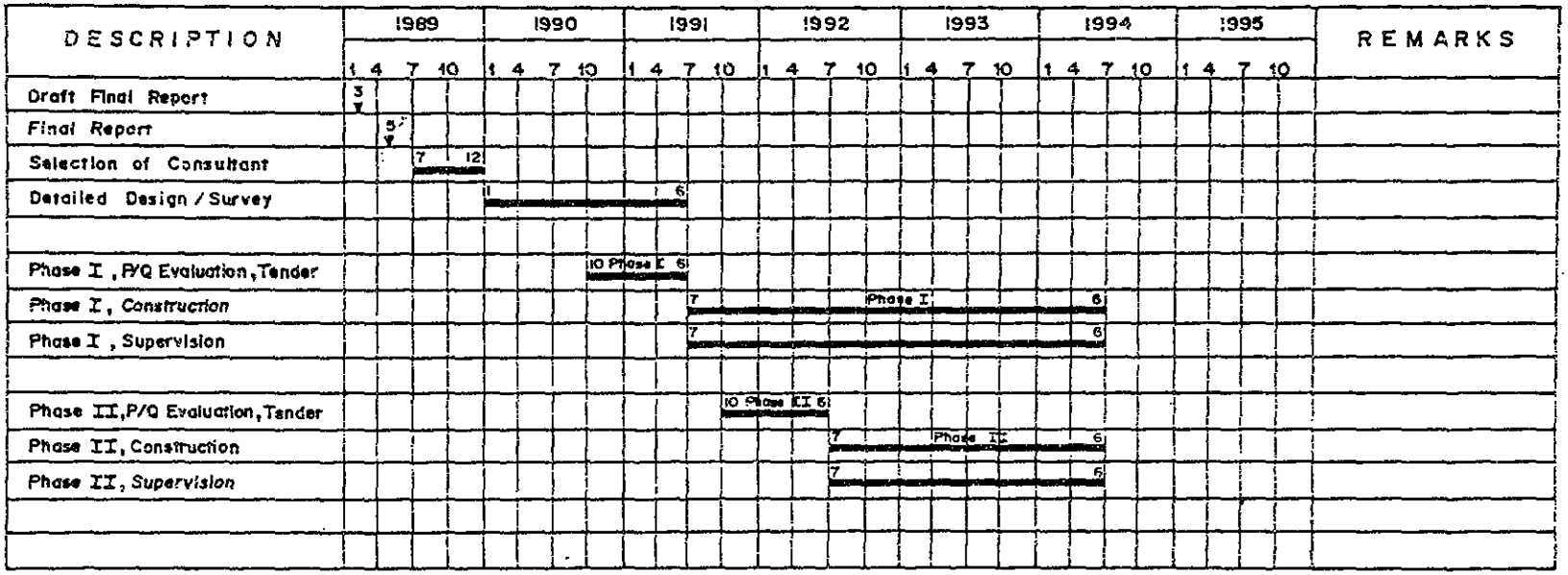
The rehabilitation program covering the 52 bridges along the Manila North Road and the Pan-Philippine Highway involves reconstruction, replacement of superstructure and repair. The total project cost amounts to 907,276 x 10^3 Pesos with foreign portion of 612,958 x 10^3, local portion of 203,687 x 10^3 and taxes of 90,631 x 10^3. For the effective and prompt implementation of urgent rehabilitation, the phasing strategy for implementation is adopted based on the priorities determined through the economic evaluation and consideration of construction packages.

4.8.1 Implementation Schedule

The overall project implementation was scheduled for 4 years and 6 months from the detailed engineering studies to the completion of the construction. The detailed engineering studies which would take one and a half (1.5) year would include, mainly topographic survey, geotechnical survey and detailed design. The prequalification evaluation and tender process will also be carried out in parallel with the detailed engineering studies. The construction period would be 3 years, with Phase-I of 3 years and Phase-II of 2 years as shown in the barchart of the Implementation Schedule.

The detailed engineering studies involve topographical survey of the bridge sites, geotechnical survey at locations considered to be required for the foundation design and the detailed design which will be conducted with a review of the feasibility study results. The prequalification of contractors, tender calling and bidding will be carried out during the tender process prior to the construction. The construction will be divided into 2 phases, taking into consideration the priority from the economic evaluation results. The rehabilitation program, however, should be completed in a short period. The construction of Phase-I and Phase-II is recommended to be carried out simultaneously.

IMPLEMENTATION SCHEDULE



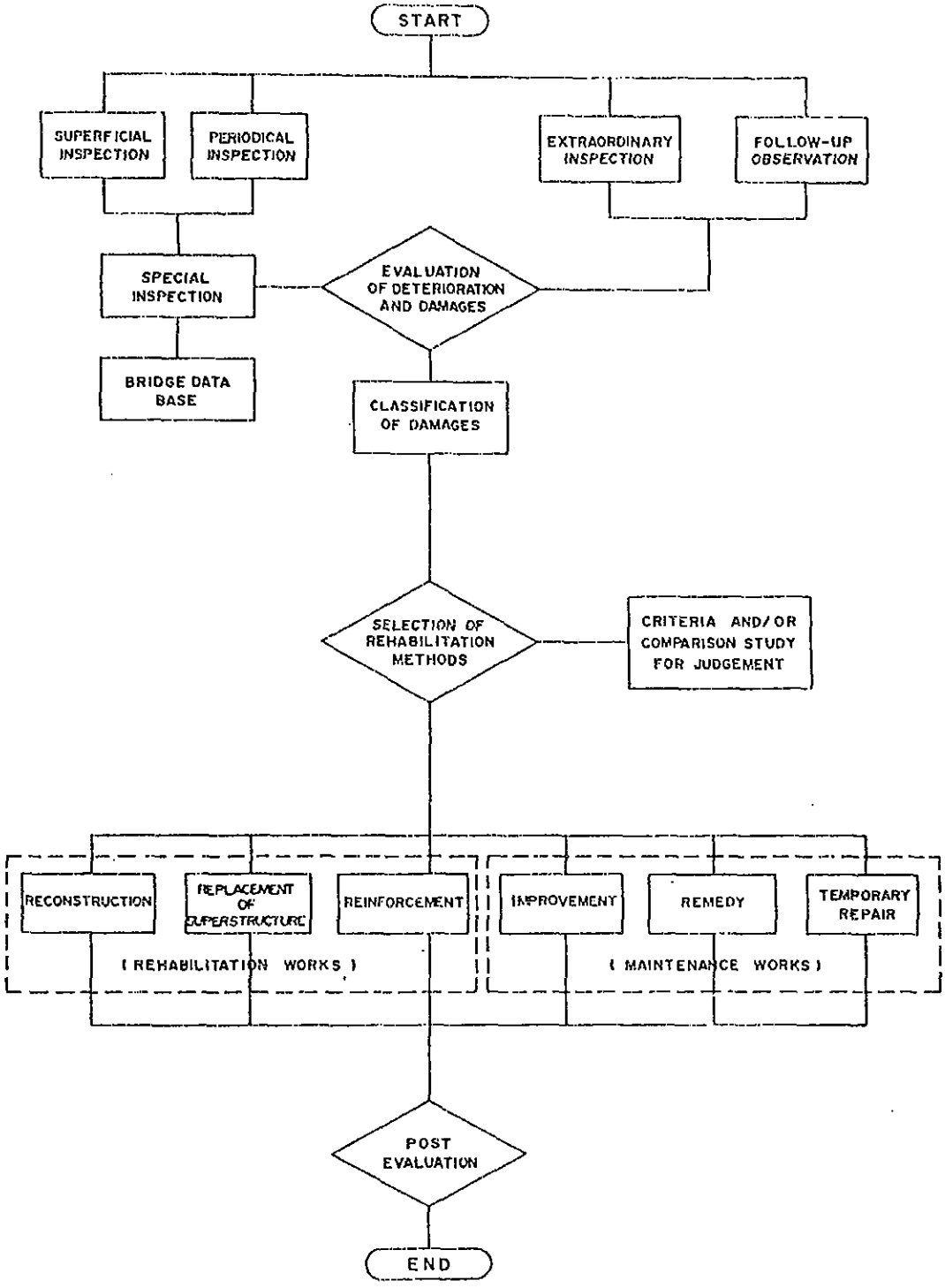
4.9 Preparation of an Approach on Bridge Inspection and Maintenance Report

Through the Feasibility Study, the study team examined the systematical process of the inspection and maintenance in consideration of the Philippine bridge features, design standard, and organization of DPWH etc. The flow chart diagram for inspection and maintenance is mentioned in the next page. The Bridge Inspection and Maintenance Report was prepared as a separate volume from the main report, compiling the ideas and method used in visual and detailed survey and preliminary design.

The Inspection and Maintenance Report covers bridge inspection, bridge maintenance and rehabilitation organization and training and inspection and maintenance for the Magapit suspension bridge. Since the guidelines and recommendations in the Inspection and Maintenance Report were carefully prepared taking into consideration the situation in the Philippines, the use of report will be useful for DPWH.

The establishment of a special inspection team, to take definitive decision regarding assessment and rating of deterioration and damages with up-dated inspection techniques, is specially recommended in the Inspection and Maintenance Report. Emphasis is also laid on the importance of training of bridge engineers and inspection specialists participating in the Special Inspection Team.

FLOW CHART DIAGRAM FOR INSPECTION AND MAINTENANCE



4.10 Establishment of Bridge Data Base

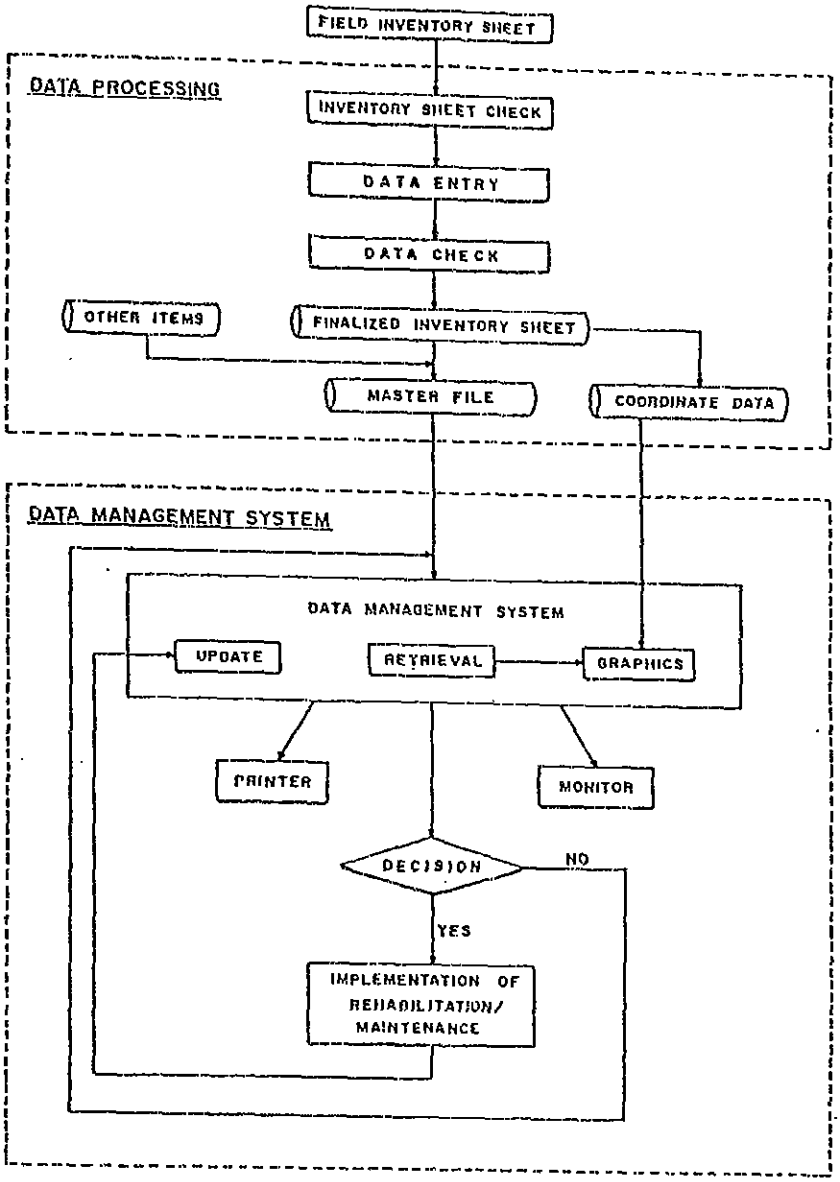
The Bridge Data Management System (BRIDAMAS) intends to manage the data of individual bridges by using Personal Computer. The main purposes are to maintain necessary bridge data systematically for easy retrieval and updating and to prepare the planning basis required for engineering and management work of bridge maintenance and improvement work with minimum efforts and maximum efficiency.

In designing the system, the following factors were taken into consideration, i.e. to facilitate users' convenience for input and retrieval of data by designing a simple system, to facilitate better understanding of users by incorporating a graphics function, and to facilitate updating or renewal of bridge data, when and where necessary.

BRIDAMAS consists of data processing and data management. Data Processing involves five processes, i.e. inventory sheet check, data check, finalized inventory sheet and master file. Data Management System involves three sub-systems, i.e. Updating, Retrieval and Graphics.

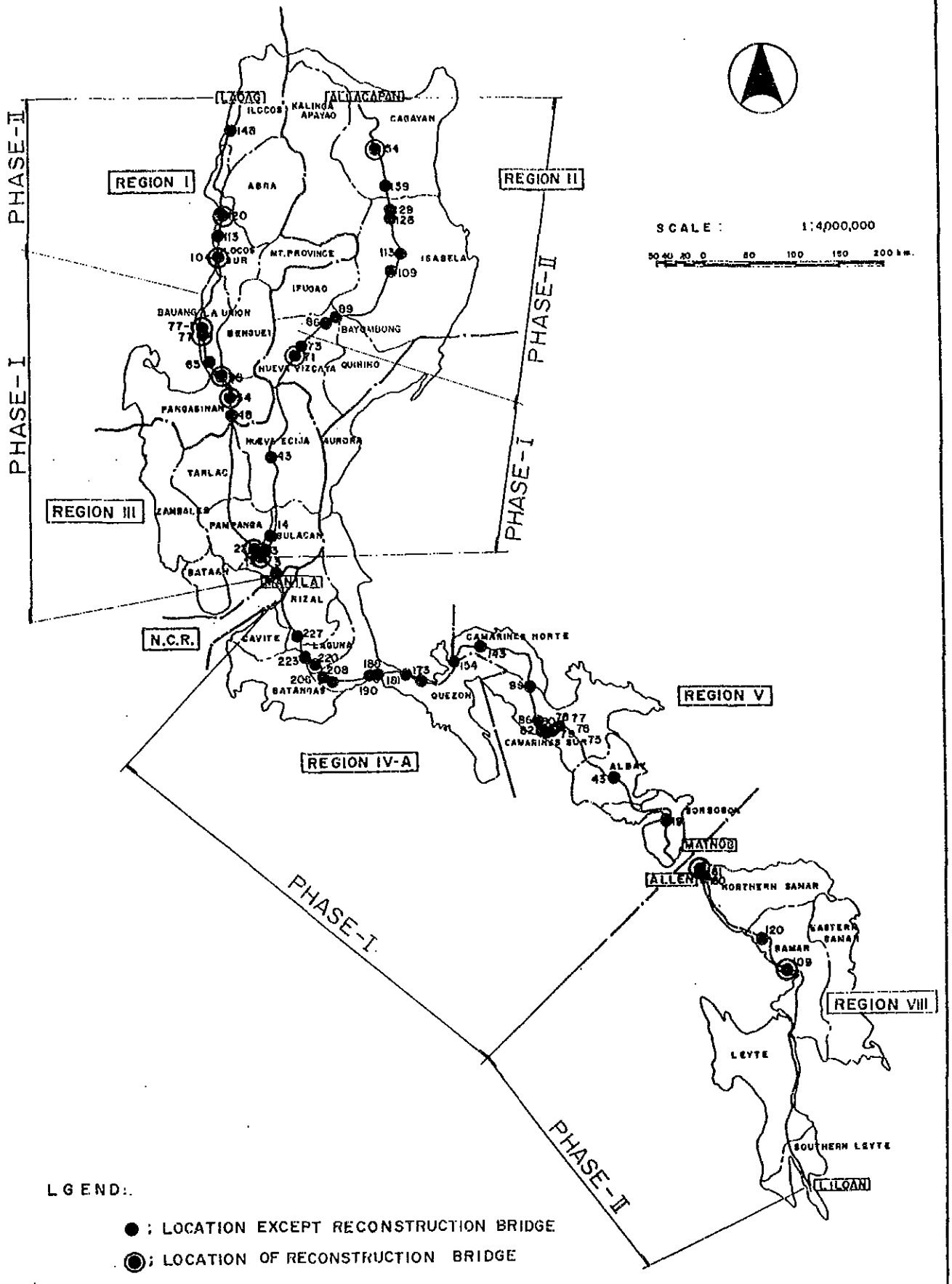
A necessary Operation Manual was prepared and transferring was also conducted for DPWH officials to familiarize themselves with the working and mechanics of the system of the Bridge Data Base. The Operation Manual includes bridge data base management system, updating system, retrieval system and graphics.

FLOW CHART PROGRAM OF BRIDGE DATA MANAGEMENT SYSTEM



APPENDICES

PHASING SYSTEM FOR REHABILITATION BRIDGES



FEATURES OF DESIGNED BRIDGE (1)

HIGH-WAY	SECTION	REG.	COMMU-LATIVE NO.	BR. NO.	BRIDGE NAME	EXISTING BRIDGE			JUDGEMENT	REHABILITATION METHODS	PROPOSED BRIDGE				52 BRIDGES	
						TYPES	SPAN	LENGTH			TYPES	SPAN	LENGTH	WIDTH	22	30
MANILA NORTH ROAD	MANILA - LAOAG	III	1	3	MARILAO	RCDG	5@12	60.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF ONE SPAN RCDG WIDENING OF CAP	RCDG	1@12.00	12.00	0.76+8.50+0.76		●
			2	14	LABANGAN I	S I B	25+50+25	100.00	RECONSTRUCTION	RECONSTRUCTION LINK SLAB	S I B	8@32.50	260.00	0.76+8.50+0.76	●*	
			3	22	SULIPAN	PONY/TRUSS	3@25.3+3@36.9+3@25.3	328.50	RECONSTRUCTION	RECONSTRUCTION LINK SLAB	SIB/STEEL BOX	3@25.30+3@53.90+3@25.30	328.50	0.76+8.00+0.76		●*
		I	4	48	PLARIDEL	TRUSS	13@46.854	635.10	REPAIR	REPLACEMENT OF DECK SLAB REINFORCEMENT OF PIER	TRUSS	13@46.854	635.10	0.76+7.40+0.76		○
			5	54	TAGAMUSING	RCDG	4@10.00	40.00	RECONSTRUCTION	RECONSTRUCTION	PC-I	15.00+20.00+15.00	50.00	0.76+8.00+0.76	●*	
			6	58	SUED	PONY/TRUSS/S.I.B. RCDG	3@24.90+3@50.00+15.80+15.70+6@25.00+3@30.80	500.38	RECONSTRUCTION	RECONSTRUCTION	PC-I/PC-T	9@25+1@32.50+6@25+3@31.00	500.50	0.76+8.00+0.76	●*	
			7	65	LOMBOY	RCDG	3@15.00	45.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF ONE SPAN RCDG WIDENING OF CAP	RCDG	1@15.00	15.00	0.76+7.45+0.76	●	
			8	77	BAUANG I	PONY	8@25.00+21.40	221.40	RECONSTRUCTION	RECONSTRUCTION	PRECAST-T PC-I	1@10+9@25.00	235.00	0.76+7.32+0.76	●*	
			9	77-1	BAUANG II	PONY	8@23.40	187.20	RECONSTRUCTION	RECONSTRUCTION	PC-I	8@23.40	187.20	0.76+7.32+0.76		●*
			10	104	STA. CRUZ I	S I B/RCDG	21.70+13@11.70+4@21.70	260.60	RECONSTRUCTION	EXTENSION OF TWO SPAN	S I B	2@17.5	35.00	0.76+7.35+0.76		●*
			11	113	LANGLANGKA I	RCDG	2@7.00	14.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF PC-I & WIDENING OF CAP, REMOVAL OF PIER	PC-I	1@14.00	14.00	0.76+7.32+0.76		●
			12	120	STA. MARIA	TRUSS	6@49.7	298.20	REPAIR RECONSTRUCTION	EXTENSION OF TWO SPAN REPLACEMENT & REINFORCEMENT OF DECK SLAB	PC-I/TRUSS	2@22.5+6@49.7	343.20	0.76+8.35+0.76		●
			13	148	TIPCAL	RCDG	5@7.00	35.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF PRECAST-T REINFORCEMENT OF SUBSTRUCTURE	PRECAST-T	5@7.00	35.00	0.76+7.32+0.76		●
PAN PHILIPPINE HIGHWAY	MANILA - ALLACAPAN	III	14	3	PLARIDEL - PULILAN	S I B	2@40.00+2@38+15.20	171.20	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S I B	2@40.0+38.0+2@15.20	171.20	1.20+7.40+1.20		○
			15	14	SAN ROQUE	RCDG	7@12.00	84.00	REPAIR	REPLACEMENT OF DECK SLAB, REINFORCING OF BEAM	RCDG	2@12.00	24.00	0.80+7.35+0.80		○
			16	43	SICSICAN	TRUSS	3@50.00	150.00	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	TRUSS	3@50	150.00	1.15+7.40+1.15	○	
		II	17	71	INDIANA	S.I.B./PONY	6.40+13.50+3@25.0	88.90	RECONSTRUCTION	RECONSTRUCTION & WIDENING OF GIRDER BRIDGE.	S I B	19.5+3@25.0+15.5	110.00	0.76+7.32+0.76	●*	
			18	73	BATU	TRUSS	7@50.00	350.00	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB, ADDITIONAL SIDE WALK.	TRUSS	7@50.00	350.00	0+6.70+0	○	
			19	86	NAMAMPARAN - I	RCDG	3@15.00	46.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF RCDG WIDENING OF CAP, REINFORCEMENT OF PIER	RCDG	3@15.00	45.00	0.76+7.32+0.76		●
			20	89	SAN LUIS	RCDG	2@12.00	24.00	REPAIR	WIDENING OF CAP OF SUBSTRUCTURE	RCDG	——	—	0.76+6.75+0.76		○
			21	109	NAGUILIAN	S I B/TRUSS	4@15+6@75.0+15.0	675.00	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	SIB/TRUSS	8@75.0	600.00	0.75+6.15+0.75	○	
			22	113	MALALAM	S I B/TRUSS	15.7+6@74+15.7	475.40	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	SIB/TRUSS	6@74.0	444.00	0.70+6.15+0.70	○	
			23	126	BALASIG	TRUSS	1@75.00	75.00	REPAIR	REPLACEMENT OF DECK SLAB ADDITIONAL SIDE WALK	TRUSS	1@75.00	75.00	0+6.20+0		○
			24	129	SAN PABLO	S I B/TRUSS	2@15.60+4@58.0+15.60	278.80	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S I B/TRUSS	4@58.00	232.00	0.76+7.20+0.76		○
			25	139	PINACANAUAN	S I B/TRUSS	15.90+3@60.0+15@12.50	383.40	REPAIR	REPLACEMENT OF DECK SLAB REINFORCEMENT OF PIER	S I B/TRUSS	3@60 (P5~P7)	180.00	0.67+6.06+0.67	○	
			26	154	PARED	RIGID FRAME PONY TRUSS	37.5+8.00+3@49.2	193.10	RECONSTRUCTION	RECONSTRUCTION OF TWO SPAN REPLACEMENT/REINFORCEMENT OF DECK SLAB	PC-I/TRUSS	3@49.2+2@25.00	197.60	0.76+6.70+0.76	●*	

NOTE : ●* : RECONSTRUCTION ● : REPLACEMENT OF SUPERSTRUCTURE ○ : REPAIR

FEATURES OF DESIGNED BRIDGE (2)

HIGH WAY	SEC-TION	REG.	COMMU-LATIVE NO.	BR. NO.	BRIDGE NAME	EXISTING BRIDGE			JUDGEMENT	REHABILITATION METHODS	PROPOSED BRIDGE				52 BRIDGES	
						TYPES	SPAN	LENGTH			TYPES	SPAN	LENGTH	WIDTH	22	30
PAN PHILIPPINE HIGHWAY	MATNOG - MANILA	V	27	19	SUJE (RIZAL)	RC SLAB	2 @ 6.0	12.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEME OF PRECAST-T LINK SLAB, WIDENING OF ABUT.	PRECAST-T	1 @ 12.00	12.00	0.76+7.32+0.76	●	
			28	43	GUINOBATAN	S.I.B	27.70+27.90	55.60	REPAIR	REINFORCEMENT OF ABUTMENT LINK SLAB	S.I.B	-	-	0.45+7.30+0.45		O
			29	75	SAN FERNANDO	S.I.B	1 @ 21.80	21.80	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S.I.B	1 @ 21.80	21.80	0.76+7.40+0.76		O
			30	76	PAMUKID	S.I.B	2 @ 6.50+9.50	22.50	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S.I.B	6.50+9.50+6.50	22.50	0.75+7.40+0.75		O
			31	77	SAN ISIDRO	S.I.B	2 @ 6.50+9.50	22.50	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S.I.B	2 @ 6.50+9.50	22.50	0.75+7.45+0.75		O
			32	78	SAN GABRIEL	RC SLAB	3 @ 6.50	19.50	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF RC-SLAB	RC - SLAB	3 @ 6.50	19.50	0.76+7.32+0.76	●	
			33	79	PAHOHO	RCDG	1 @ 12.00	12.00	REPAIR	REPLACEMENT OF DECK SLAB	RCDG	1 @ 12.00	12.00	0.50+7.35+0.50		O
			34	80	TINIGUIBAN	RCDG	6.00+13.90	19.90	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF RCDG WIDENING CAP, LINK SLAB	RCDG	1@6.00+1@13.90	19.90	0.76+7.32+0.76		●
			35	82	SGT. MATIAS	RCDG	1 @ 15.00	15.00	REPAIR	REPLACEMENT OF DECK SLAB SLOPE PROTECTION, WIDENING CAP	RCDG	1 @ 15.00	15.00	0.50+7.70+0.50		O
			36	86	NAUBCD I	S.I.B	1 @ 15.00	15.00	REPAIR	REPLACEMENT OF DECK SLAB SLOPE PROTECTION	S.I.B	1 @ 15.00	15.00	0.75+7.40+0.76		O
			37	99	SOOK	S.I.B	3 @ 11.10	33.30	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S.I.B	3 @ 11.10	33.30	0.80+7.35+0.80		O
			38	143	KAPANAWAN	S.I.B	3 @ 15.20	45.60	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S.I.B	3 @ 15.20	45.60	0.50+7.35+0.50		O
			39	154	BASIAD	TRUSS	1 @ 58.50	58.50	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	TRUSS	1 @ 58.50	58.50	0.75+7.40+0.75		O
		IV-A	40	173	GUMACA	RCDG	6 @ 7.70	46.20	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF RCDG AND WIDENING OF CAP	RCDG	4 @ 7.70	30.80	0.76+7.50+0.76		●
			41	181	TALABA	RCDG	4 @ 5.80	23.20	REPLACEMENT OF SUPERSTRUCTURE	SLOPE PROTECTION REPLACEMENT OF RCDG & WIDENING OF CAP, LINK SLAB	RCDG	2 @ 11.6	23.20	0.76+7.32+0.76		●
			42	188	BINAHAAN	RCDG	2@10.00+2@14	48.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF RCDG WIDENING OF CAP	RCDG	2 @ 14	28.00	0.75+6.70+0.75	●	
			43	190	PALSABANGON	RCDG	3@15.00+12.00	57.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF RCDG PIER FOUNDATION PROTECTION WIDENING OF CAP	RCDG	2 @ 15.00	30.00	0.75+7.35+0.75		●
			44	206	LAGNAS II	RC SLAB	4 @ 5.00	20.00	REPAIR	OVERLAY REPAIR OF DECK SLAB	RC - SLAB	4 @ 5.00	20.00	0.50+6.60+0.50		O
			45	208	STO. CRISTO	RCDG	3 @ 12.00	36.00	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF RCDG WIDENING OF CAP	RCDG	3 @ 12.00	30.00	0.76+7.32+0.76	●	
			46	220	MAGAPONG	PONY	1 @ 25.70	25.70	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF PC-I REINFORCEMENT OF ABUTMENT	PC-I	1 @ 25.70	25.70	0.76+7.32+0.76	●	
			47	223	BIGA	S.I.B	2 @ 7.00+32.0	46.00	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	S.I.B	2 @ 7.00+32.00	46.00	0.76+7.32+0.76		O
			48	227	SAN CRISTOBAL	RCDG/TRUSS	2 @ 12.00+49.60	73.60	REPAIR	REPLACEMENT & REINFORCEMENT OF DECK SLAB	RCDG/TRUSS	1 @ 49.60	49.60	0.75+6.00+0.75	O	
	LILOAN-ALLEN	VIII	49	109	JIABONG	RC SLAB	11 @ 6.80	74.80	RECONSTRUCTION	RECONSTRUCTION	PC-I	3 @ 25.00	75.00	0.76+7.32+0.76	●*	
			50	120	HINOGBONGAN	S.I.B	1 @ 21.80	21.80	REPAIR	REINFORCEMENT OF ABUTMENT LINK SLAB	S.I.B	-	-	0.45+7.30+0.45	O	
			51	160	JUBASAN II	PONY	1 @ 44.60	44.60	REPLACEMENT OF SUPERSTRUCTURE	REPLACEMENT OF PC-I REINFORCEMENT OF ABUTMENT	PC-I	2 @ 22.30	44.60	0.76+7.32+0.76	●	
			52	161	JUBASAN I	TRUSS	1 @ 74.00	74.00	RECONSTRUCTION	RECONSTRUCTION	PC-I	2 @ 37.00	74.00	0.76+7.32+0.76	●*	

note ; ●*; RECONSTRUCTION ●; REPLACEMENT OF SUPERSTRUCTURE O; REPAIR

SUMMARY OF CONSTRUCTION COST ESTIMATE (1/2)

Unit : Peso

Region No.	Bridge No.	Bridge Name	Classification	Contruction Cost	Component Foreign	Component Local	Taxes
1 4	48	PLARIDEL	Repair	27430243.02	18448071.69	6239147.03	2743024.30
1 5	54	TAGAMUSING	Reconstruction	11406055.06	7593823.01	2671626.54	1140605.51
1 6	58	BUED	Reconstruction	89967667.15	61799860.70	19171039.74	8996766.71
1 7	65	LOMBOY	Replacement of Superstructure	727816.95	423830.77	231204.48	72781.70
1 8	77	BAUANG I	Reconstruction	54344695.10	37334857.77	11575367.81	5434469.51
1 9	77-1	BAUANG II	Reconstruction	33512812.91	22469123.20	7692408.42	3351281.29
1 10	104	STA CRUZ I	Reconstruction for Extension span	14009919.61	9824619.78	2784307.87	1400991.96
1 11	113	LANGLANGKA I	Replacement of Superstructure	1949666.36	1145944.64	608755.09	194966.64
1 12	120	STA MARIA	Reconstruction for Extension span	25175444.47	17258342.34	5399557.68	2517544.45
1 13	148	TIPCAL	Replacement of Superstructure	2634141.57	1701682.54	669044.87	263414.16
3 1	3	MARILAO	Replacement of Superstructure	889215.27	524765.92	275527.83	88921.53
3 2	14	LABANGAN I	Reconstruction	55712209.06	40391523.86	9749464.29	5571220.91
3 3	22	SULIPAN	Reconstruction	92133556.67	68408313.11	14511887.89	9213355.67
		Sub-total		409893443.20	287324759.33	81579339.54	40989344.34
				(100.0 %)	(70.1 %)	(19.9 %)	(10.0 %)
2 17	71	INDIANA	Reconstruction for Extension span	19714998.19	13224013.60	4519484.77	1971499.82
2 18	73	BATU	Repair	23567370.57	15646269.90	5564363.61	2356737.06
2 19	86	NAHANPARAN I	Replacement of Superstructure	3668474.49	1890752.26	1410874.78	366847.45
2 20	89	SAN LUIS	Repair	230225.60	124385.27	82817.77	23022.56
2 21	109	NAGUILAN	Repair	22321970.69	14660026.94	5429746.68	2232197.07
2 22	113	MALALAM	Repair	6767872.09	3927329.45	2163755.43	676787.21
2 23	126	BALASIG	Repair	3000923.02	1738254.83	962575.90	300092.30
2 24	129	SAN PABLO	Repair	10960469.17	7346386.69	2518035.56	1096046.92
2 25	139	PINACANAUAN	Repair	11015591.78	6944414.88	2969617.72	1101559.18
2 26	154	PARED	Reconstruction	16592853.29	11025191.21	3908376.75	1659285.33
3 14	3	PLARIDEL-PULILAN	Repair	21170126.42	15220493.81	3832619.98	2117012.64
3 15	14	SAN ROQUE	Repair	545320.11	316563.45	174224.64	54532.01
3 16	43	SICSICAN	Repair	2994489.65	1853907.57	841133.11	299448.96
		Sub-total		142550685.07	93917989.86	34377626.70	14255068.51
				(100.0 %)	(65.8 %)	(24.1 %)	(10.0 %)
5 27	19	SUJE(RIZAL)	Replacement of Superstructure	2352451.07	1470754.46	646451.50	235245.11
5 28	43	GUINOBATAN	Repair	660203.22	381351.34	212831.56	66020.32
5 29	75	SAN FERNANDO	Repair	1264748.64	704835.13	433438.64	126474.86
5 30	76	PAMUKID	Repair	823762.07	422533.43	318852.43	82376.21
5 31	77	SAN ISIDRO	Repair	1259921.24	710636.26	423292.85	125992.12
5 32	78	SAN GABRIEL	Replacement of Superstructure	1243849.22	637929.86	481534.43	124384.92
5 33	79	PANOHO	Repair	202781.25	111091.95	71411.18	20278.12
5 34	80	TINIGUIBAN	Replacement of Superstructure	1254652.00	673329.97	455856.83	125465.20
5 35	82	SGT. MATIAS	Repair	148878.26	89475.03	44515.41	14887.83
5 36	86	NAUBOD I	Repair	713091.87	334385.71	307396.97	71309.19
5 37	99	SOOK	Repair	667039.54	424708.85	175626.73	66703.95
5 38	143	KANAPAWAN	Repair	1163000.09	642734.15	403965.93	116300.01
5 39	154	BASIAD	Repair	2048324.85	1356943.98	486548.38	204832.48
		Sub-total		13802703.32	7960710.12	4461722.64	1380270.32
				(100.0 %)	(57.6 %)	(32.3 %)	(10.0 %)
4 40	173	GUMACA	Replacement of Superstructure	1916937.84	1205135.04	520109.01	191693.78
4 41	181	TALABA	Replacement of Superstructure	1984034.93	1049107.62	736523.81	198403.49
4 42	188	BINAHAAN	Replacement of Superstructure	3044253.58	1795745.47	944082.75	304425.36
4 43	190	PALSABANGON	Replacement of Superstructure	3213256.29	1526736.97	1365193.69	321325.63
4 44	206	LAGNAS II	Repair	147430.08	89773.73	42913.34	14743.01
4 45	208	STO CRISTO	Replacement of Superstructure	2201455.65	1145159.40	836150.68	220145.56
4 46	220	MAGAPONG	Replacement of Superstructure	2253899.17	1465773.64	562735.61	225389.92
4 47	223	BIGA	Repair	723830.03	439570.93	211876.10	72383.00
4 48	227	SAN CRISTOBAL	Repair	4477706.85	3171463.12	858473.04	447770.68
		Sub-total		19962804.42	11888465.92	6078058.03	1996280.43
				(100.0 %)	(59.5 %)	(30.4 %)	(10.0 %)
8 49	109	JIADONG	Reconstruction	14485412.54	9841303.57	3195567.72	1448541.25
8 50	120	HINOGBONGAN	Repair	1541911.03	997161.34	390558.58	154191.10
8 51	160	JUBASAN II	Replacement of Superstructure	7249198.46	4728667.80	1795610.81	724919.85
8 52	161	JUBASAN I	Reconstruction	14558244.89	9746043.60	3356376.80	1455824.49
		Sub-total		37834766.92	25313176.31	8738113.91	3783476.69
				(100.0 %)	(66.9 %)	(23.1 %)	(10.0 %)
		Grand Total		624044402.93	426405101.54	135234861.02	62404440.29
				(100.0 %)	(68.3 %)	(21.6 %)	(10.0 %)

SUMMARY OF CONSTRUCTION COST ESTIMATE (2/2)

Unit : Peso

Region	Bridge No.	Bridge Name	Classification	Contruction Cost	Component Foreign	Component Local	Taxes
1	48	PLARIDEL	Repair	27430243.02	18448071.69	6239147.03	2743024.30
1	54	TAGAMUSING	Reconstruction	11406055.06	7593823.01	2671626.54	1140605.51
1	58	BULD	Reconstruction	89967667.15	61799860.70	19171039.74	8996766.71
1	65	LOMBOY	Replacement of Superstructure	727816.95	423830.77	231204.48	72781.70
1	77	BAUANG I	Reconstruction	54344695.10	37334857.77	11575367.81	5434469.51
1	77-1	BAUANG II	Reconstruction	33512812.91	22469123.20	7692408.42	3351281.29
1	104	STA CRUZ I	Reconstruction for Extension span	14009919.61	9824619.78	2784307.87	1400991.96
1	113	LANGLANGKA I	Replacement of Superstructure	1949666.36	1145944.64	608755.69	194966.04
1	120	STA MARIA	Reconstruction for Extension span	25175444.47	17258342.34	5399557.68	2517544.45
1	148	TIPCAL	Replacement of Superstructure	2634141.57	1701682.54	669044.87	263414.16
		Sub-total		261158462.20	178000156.44	57042459.53	26115846.23
				(100.0 %)	(68.1 %)	(21.8 %)	(10.0 %)
2	71	INDIANA	Reconstruction for Extension span	19714998.19	13224013.60	4519484.77	1971499.82
2	73	BATU	Repair	23567370.57	15646269.99	5564363.61	2356737.06
2	86	NAMANPARAN I	Replacement of Superstructure	3668174.49	1890752.26	1410874.78	366847.15
2	89	SAN LUIS	Repair	230225.60	124385.27	82817.77	23022.56
2	109	NAGUILAN	Repair	22321970.69	14660026.94	5429946.68	2232197.07
2	113	MALALAM	Repair	6767872.09	3927329.45	2163755.43	676787.21
2	126	BALASIG	Repair	3000923.02	1738254.83	962575.90	300092.30
2	129	SAN PABLO	Repair	10960469.17	7346386.69	2518035.56	1096046.92
2	139	PINACANAUAN	Repair	11015591.78	6944414.88	2969617.72	1101559.18
2	154	PARED	Reconstruction	16592853.29	11025191.21	3908376.75	1659285.33
		Sub-total		117840748.89	76527025.03	29529648.97	11784074.90
				(100.0 %)	(64.9 %)	(25.0 %)	(10.0 %)
3	3	MARILAO	Replacement of Superstructure	889215.27	524765.92	275527.83	88921.53
3	14	LABANGAN I	Reconstruction	55712209.06	40391523.86	9749164.29	5571220.91
3	22	SULIPAN	Reconstruction	92133556.67	68408313.11	14511887.89	9213355.67
3	3	PLARIDEL-PULILAN	Repair	21170126.42	15220493.81	3832619.98	2117012.64
3	14	SAN ROQUE	Repair	545320.11	316563.45	174224.64	54532.01
3	43	SICSICAN	Repair	2994489.65	1853907.57	841133.11	299448.96
		Sub-total		173444917.18	126715567.72	29384857.74	17344491.72
				(100.0 %)	(73.0 %)	(16.9 %)	(10.0 %)
4	173	GUMACA	Replacement of Superstructure	1916937.84	1305135.04	520109.01	191693.78
4	181	TALABA	Replacement of Superstructure	1984034.93	1049107.62	736523.81	198403.49
4	188	BINAHAAN	Replacement of Superstructure	3044253.58	1795745.47	944082.75	304425.36
4	190	PALSABANGON	Replacement of Superstructure	3213256.29	1526736.97	1365193.69	321325.63
4	206	LAGNAS II	Repair	147430.08	89773.73	42913.31	14743.01
4	208	STO CRISTO	Replacement of Superstructure	2201455.65	1145159.40	836150.68	220145.56
4	220	MAGAPONG	Replacement of Superstructure	2253899.17	1465773.64	562735.61	225389.92
4	223	BIGA	Repair	723830.03	439570.93	211876.10	72383.00
4	227	SAN CRISTOBAL	Repair	4477706.85	3171463.12	858473.04	447770.68
		Sub-total		19962804.42	11888465.92	6078058.03	1996280.43
				(100.0 %)	(59.5 %)	(30.4 %)	(10.0 %)
5	19	SUJE(RIZAL)	Replacement of Superstructure	2352451.07	1470751.16	646451.50	235245.11
5	43	GUINOBATAN	Repair	660203.22	381351.34	212831.56	66020.32
5	75	SAN FERNANDO	Repair	1261748.64	704835.13	433438.64	126174.86
5	76	PAMUKID	Repair	823702.07	422533.43	318852.43	82370.21
5	77	SAN ISIDRO	Repair	1259921.24	710636.26	423292.85	125992.12
5	78	SAN GABRIEL	Replacement of Superstructure	1243849.22	637929.86	481534.43	124384.92
5	79	PANOHO	Repair	202781.25	111091.95	71411.18	20278.12
5	80	TINIGUIBAN	Replacement of Superstructure	1254652.00	673329.97	455856.83	125465.20
5	82	SGT. MATIAS	Repair	148878.26	89475.03	44515.41	14887.83
5	86	NAUBOD I	Repair	713091.87	334385.71	307396.97	71309.19
5	99	SOOK	Repair	667039.54	424708.85	175626.73	66703.95
5	143	KANAPAWAN	Repair	1163000.09	642734.15	403965.93	116300.01
5	154	BASIAD	Repair	2048324.85	1356943.98	486548.38	204832.48
		Sub-total		13802703.32	7960710.12	4461722.84	1380270.32
				(100.0 %)	(57.6 %)	(32.3 %)	(10.0 %)
8	109	JIABONG	Reconstruction	14485412.54	9841303.57	3195567.72	1448541.25
8	120	HINOGDONGAN	Repair	1541911.03	997161.31	390558.58	154191.10
8	160	JUBASAN II	Replacement of Superstructure	7249198.46	4728667.80	1795610.81	724919.85
8	161	JUBASAN I	Reconstruction	14558244.89	9746043.60	3356376.80	1455824.49
		Sub-total		37834766.92	25313176.31	8738113.91	3783476.69
				(100.0 %)	(66.9 %)	(23.1 %)	(10.0 %)
		Grand Total		624044402.93	426405101.54	135234861.02	62404440.29
				(100.0 %)	(68.3 %)	(21.6 %)	(10.0 %)

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