5.3 BASIC PLAN

5.3.1 Design for High Water Level

Design for high water level follows the Basic Design Study Report on the Project for Constructing Bridges along Rural Road (Phase III) which was submitted on March 1990 to the Government of Philippines.

Table 5.3-1 shows the rainfall data of Apollo bridge site. And Table 5.3-2 shows the results of the hydrological analysis for Apollo bridge.

Table 5.3-1 CLIMATE AND RAINFALL

Bridge No.	Name of Bridge	Location (Province)	Climate	Rainfall Intensity Data Reference
03.S	Apollo	Bataan	I	Iba, Zambales

Table 5.3-2 THE RESULTS OF THE HYDROGRAPHIC ANALYSIS

Bridge No.	Name of Bridge	Drainage Area (km^2)	Design Discharge (m^3/S)	Required Opening (m^2)	Bridge Length (m)	Water Depth (m)	Average Velocity (m/S)	M.F.L. (m)		
								Computed (Elev.)	Interview (Elev.)	Design (Elev.)
03.S	Apollo	18.8	191.4	88.6	36.0	3.5	2.16	17.50	18.00	18.00

5.3.2 Topographical and Geological Survey

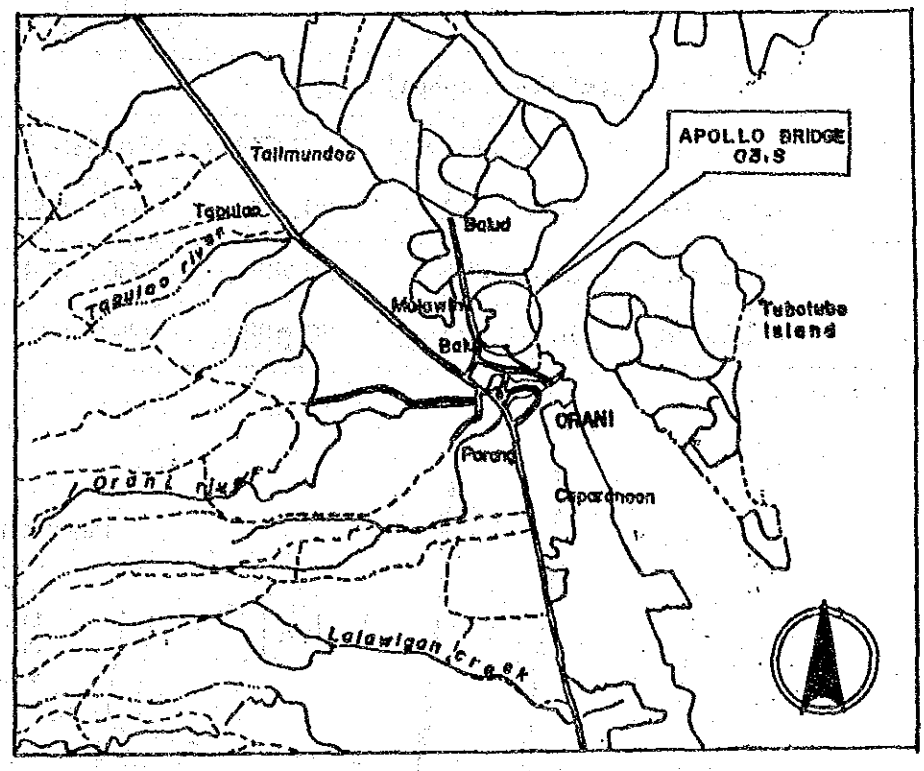
The survey items for Apollo bridge follow the report which was submitted to the Government of the Philippines on March 1990.

The result of surveys is shown below.

Result of topographical and geological surveys.

DATA OF TOPOGRAPHIC SURVEY

Bridge No.	Name of Bridge	Location	Centerline Survey (M)	Profile Survey (M)	Cross-section Survey along the Road (section)	Cross-section Survey along the River (section)	Monumenting (Point)	Topo-graphic Map (Sheet)
03.S	Apollo	Orani, Bataan	260.0	260.0	12	10	2	1



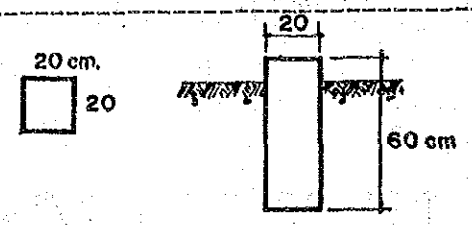
Location Map

DESCRIPTION OF TRAVERSE STATION AND BENCHMARK

03.S APOLLO BRIDGE

STATION NO.	:	BM-1 TO BM-2
MUNICIPALITY	:	Orani, Bataan
DATE ESTABLISHED	:	September 28, 1991
SIZE OF MONUMENT	:	

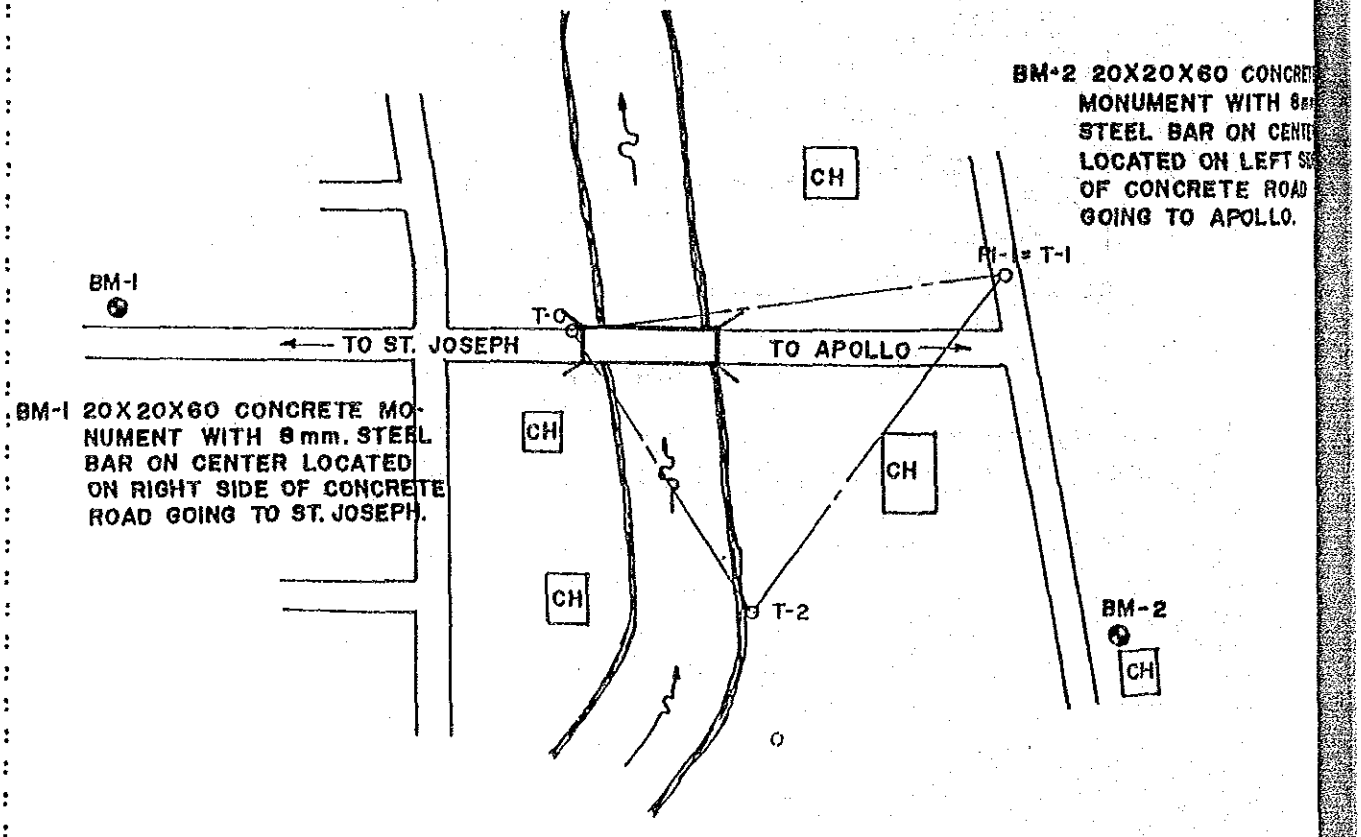
20 X 20 X 60 cm.



COORDINATES AND ELEVATION

STATION	NORTHING	EASTING	ELEVATION	REMARKS
BM-1	19963.682	20147.962	20.000	CONC. MON.
BM-2	20137.812	20057.084	20.505	CONC. MON.
PI-1	20022.118	20084.388	20.120	CONC. NAIL W/ BOTTLE CAP

SKETCH AND REMARKS :



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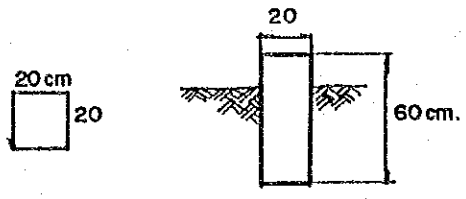

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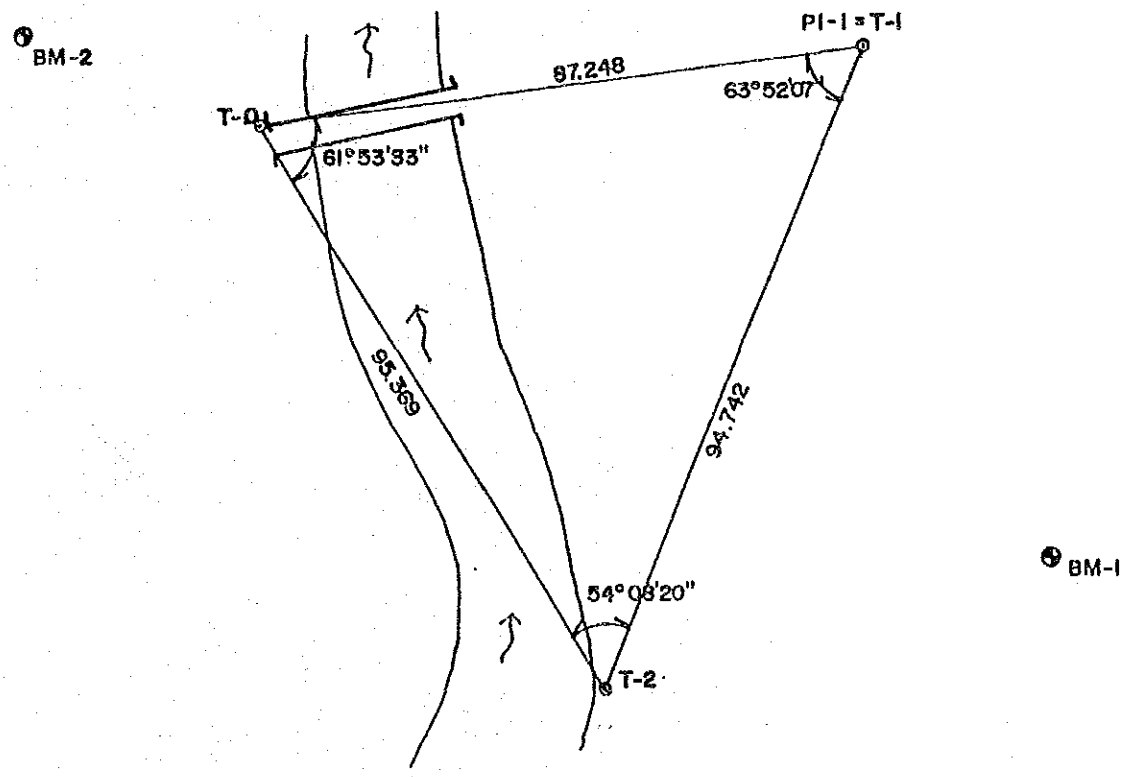
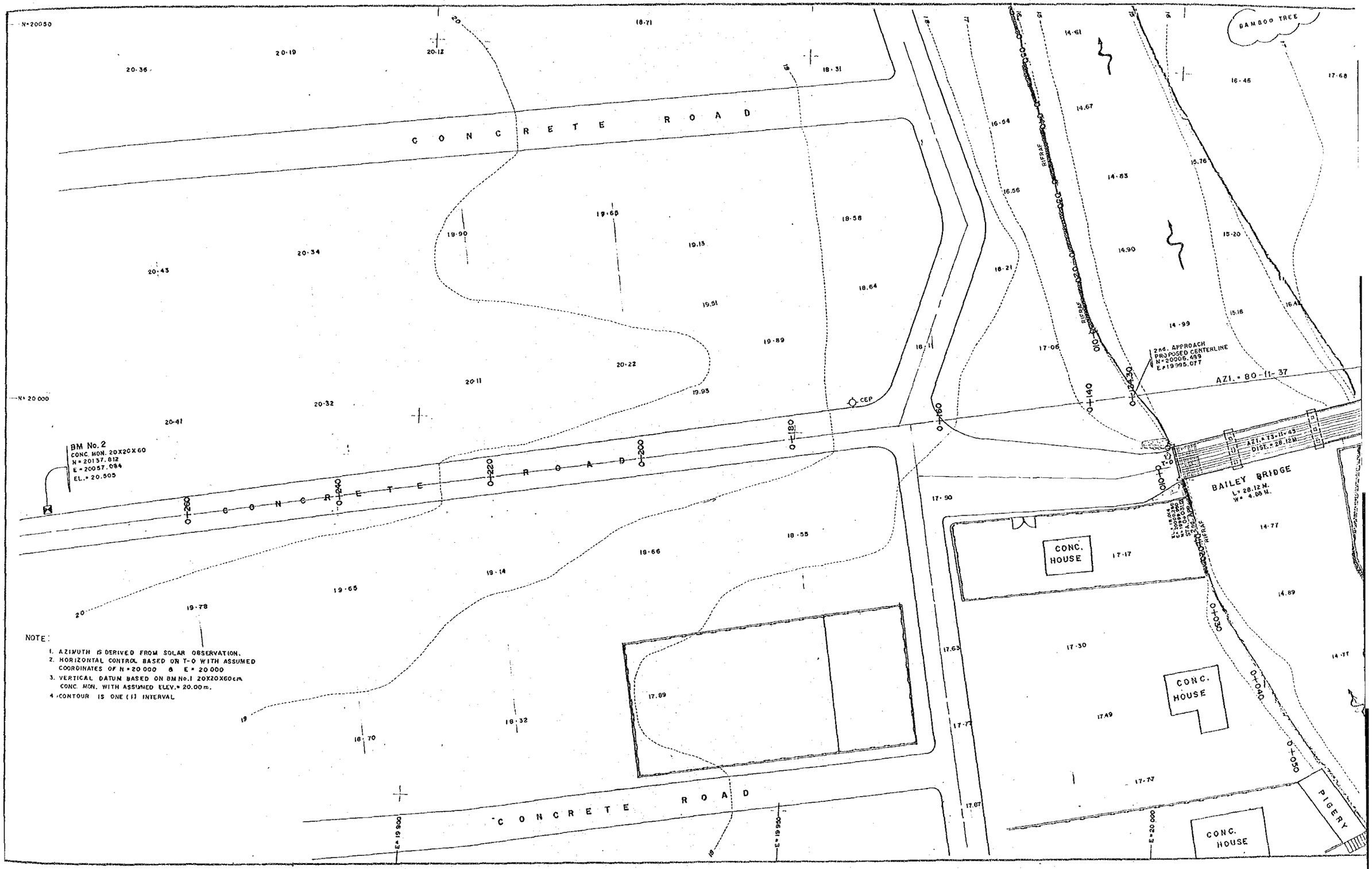
SKETCH AND REMARKS :



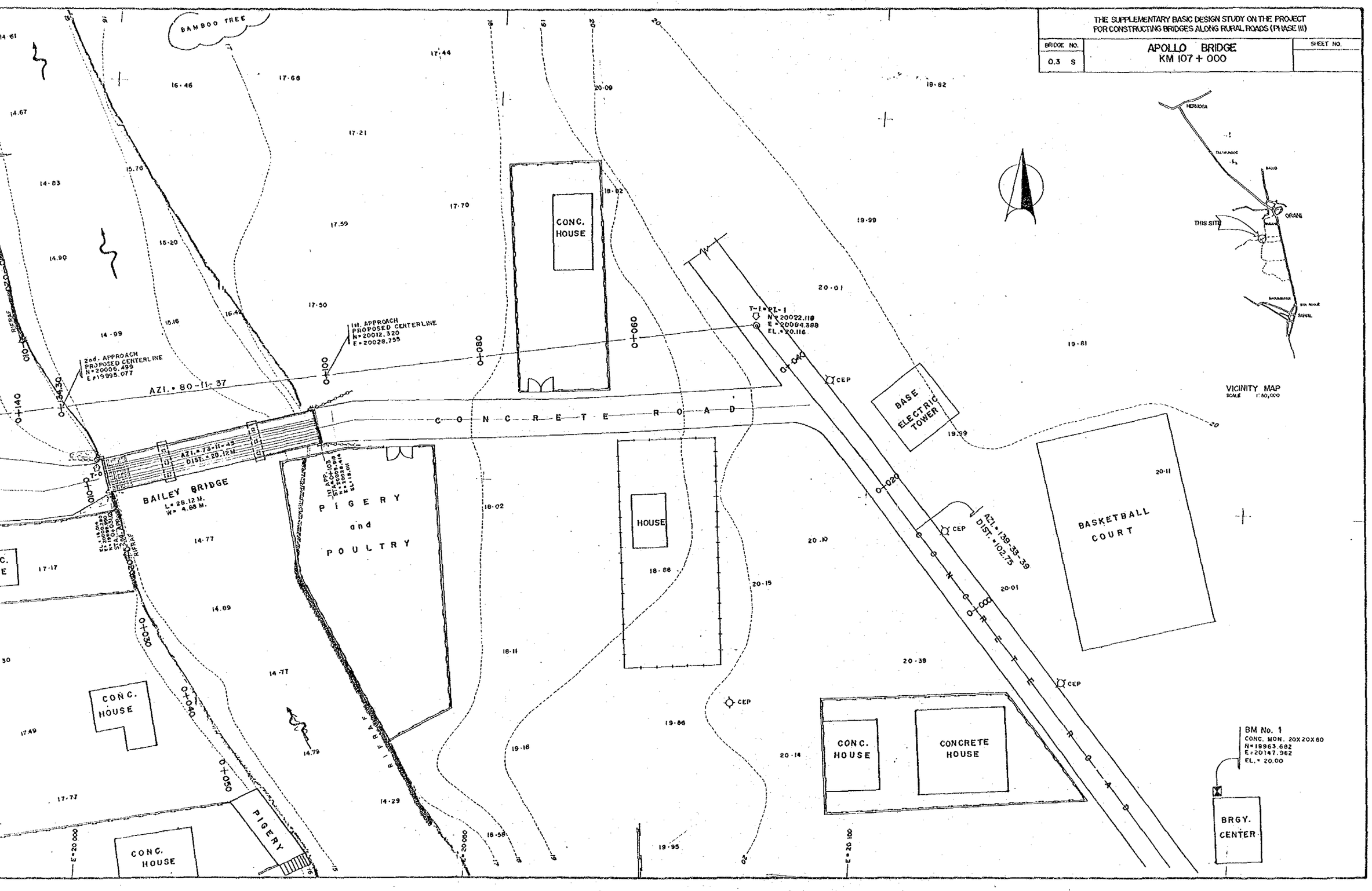


NOTE:

1. AZIMUTH IS DERIVED FROM SOLAR OBSERVATION.
2. HORIZONTAL CONTROL BASED ON T-O WITH ASSUMED COORDINATES OF N = 20 000 & E = 20 000
3. VERTICAL DATUM BASED ON BM No.1 20X20X60cm. CONC. MON. WITH ASSUMED ELEV.= 20.00m.
4. CONTOUR IS ONE (1) INTERVAL

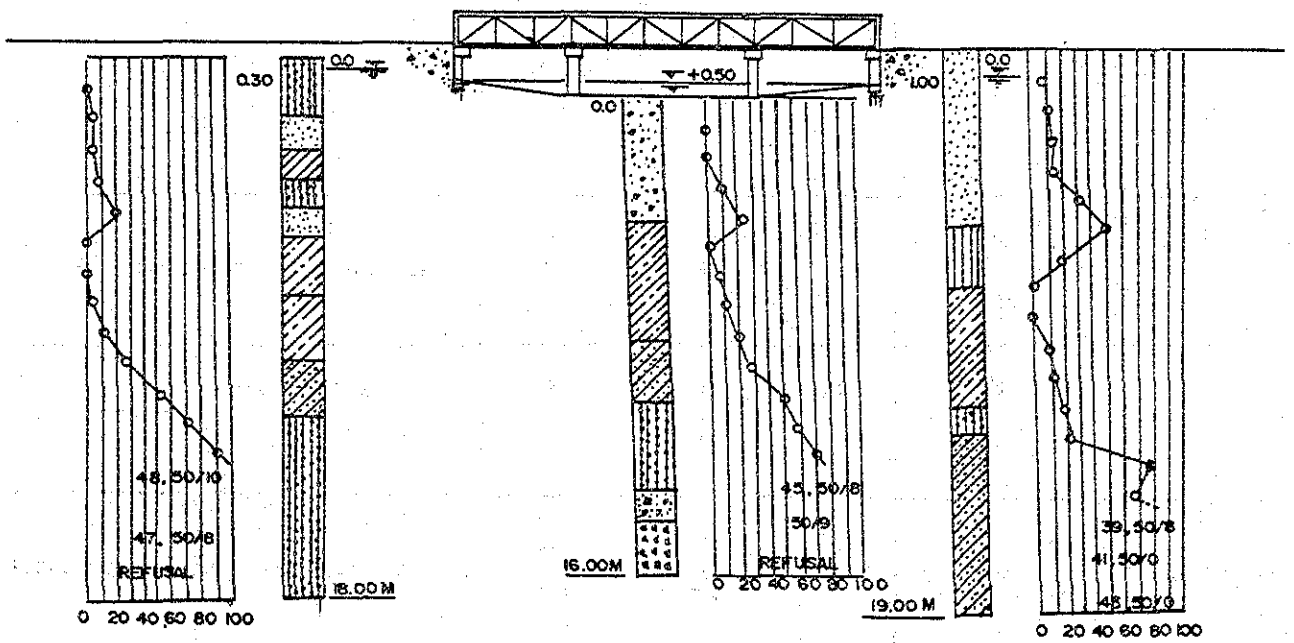
THE SUPPLEMENTARY BASIC DESIGN STUDY ON THE PROJECT
FOR CONSTRUCTING BRIDGES ALONG RURAL ROADS (PHASE III)

BRIDGE NO.		SHEET NO.
0.3 S	APOLLO BRIDGE KM 107 + 000	



Bridge No. 03_S Bridge Name. APOLLO

General View	Symbol	Name of Soil (Rock) Layer	Constituted Materials (Layer)	Layer Depth (m)	Thickness (m)	N-Value	Result of Boring											
							Boring No. 1				Boring No. 2				Boring No. 3			
							Thickness (m)	N-Value	Soil Test NMC	Soil Test U.wt.	Thickness (m)	N-Value	Soil Test NMC	Soil Test U.wt.	Thickness (m)	N-Value	Soil Test NMC	Soil Test U.wt.
	FD	FLOOD DEPOSIT	SAND With GRAVEL	3 6	3 6	7 50/N	3	7 31	18 25		4	2 25	15 18		6	5 20	16 21	
	FD	FLOOD DEPOSIT	SAND W/ SHELL FRAGMENTS	5.5 11	2.5 5	2 8	2	2	25 56		2.5	2	56		5	2	20 57	
	AC 2	ALLUVIAL DEPOSIT	- SILTY CLAY - SANDY CLAY	10 16	4.5 6	2 50	6	2 50	54 60	1.52	4.5	2 27	54 56	1.53	4	2 21	57 61	1.55
	AC 2	ALLUVIAL DEPOSIT	SILTY SAND WITH GRAVEL	15 21	5	17 50/N	5	17 50/N	8 27		3	50/N	15 18		4	5 50/N	14 27	



03. S APOLLO BRIDGE

5.3.3 Type of Bridges

(1) Types of Superstructures

Prior to the decision on what type of superstructure, the span lengths for the bridges are proposed based on the hydrological controls taking into consideration the topographical, geological and construction conditions. Type of superstructures follows the prior Report (Phase III).

In this study, H-beam girder of 18 m length is adopted for Apollo bridge.

Figure 5.3-1, Figure 5.3-2 show a general view and typical section of H-beam composite girder.

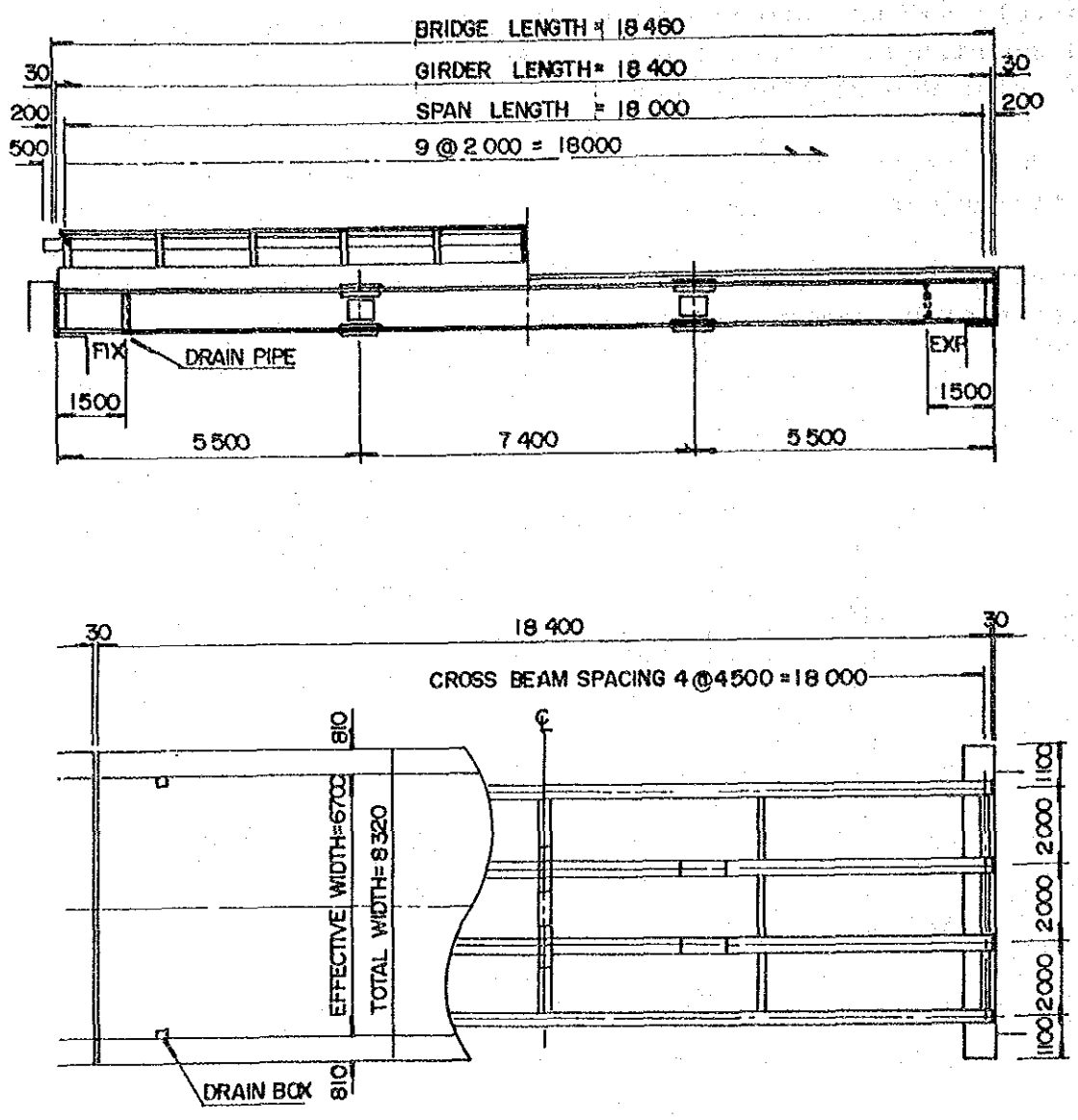
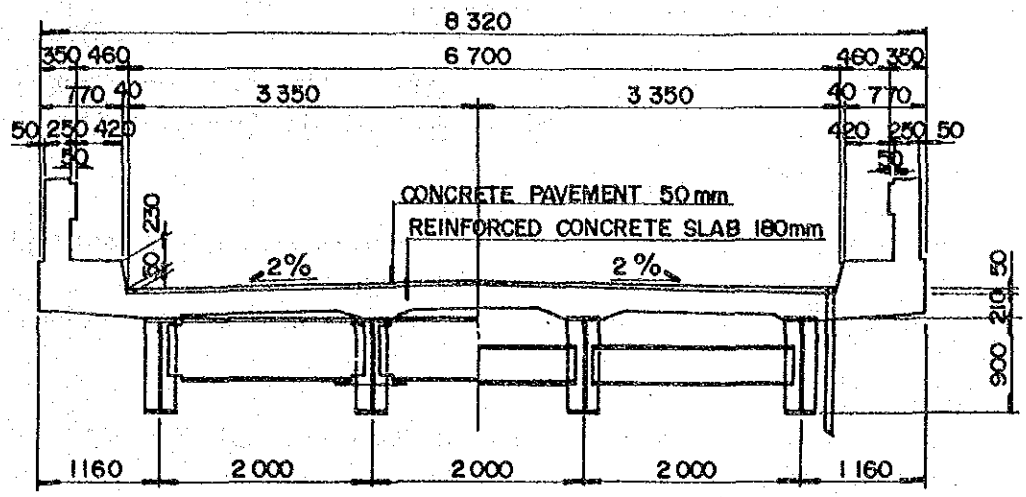


Figure 5.3-1 TYPICAL GENERAL VIEW OF BRIDGE



CROSS SECTION

(SPAN LENGTH : 18 m)

Figure 5.3-2 TYPICAL CROSS SECTION OF SUPERSTRUCTURES

(2) Types of Substructures

The types of substructures adopted for the Phase III bridges are T-type abutments and column type piers.

Column type piers are selected since the rivers cross the bridges at oblique angles, and to avoid disturbing the stream lines. Refer to Table 5.3-3.

T-type abutments on pile foundations are strongly recommended to have at least two (2) lines of piles in order to avoid tilting of the abutments and scouring of the embankments behind the abutments.

The recommended standard types of abutments and piers, both for spread footings and pile foundations, are shown in Figures 5.3-3 (1/2) - (2/2).

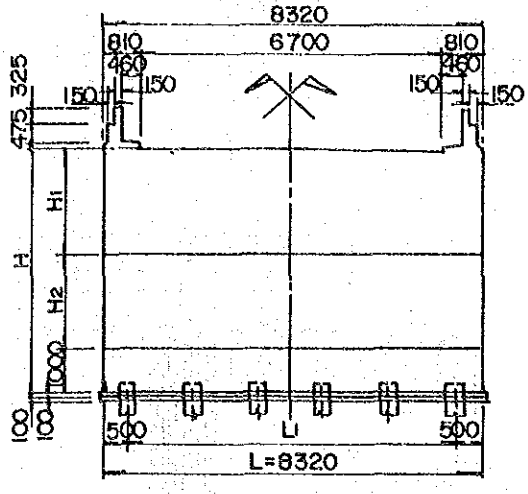
Rectangular R.C. piles of 400 x 400 mm were adopted for the pile foundations.

Table 5.3-3 STREAM ANGLE

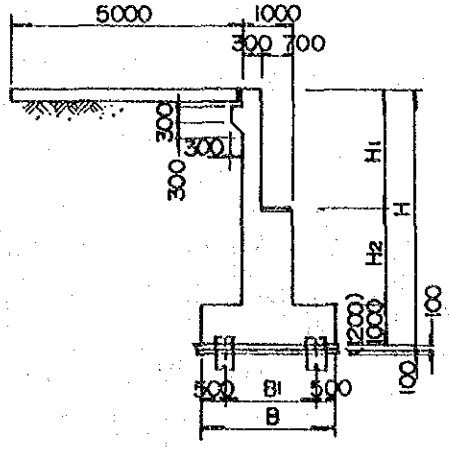
Bridge No.	Name of Bridge	Stream Angle*	Remarks
03.S	Apollo Bridge	70°	2 Span

Note: *oblique angle between stream line and bridge

Table 5.3-4 shows the summary of Apollo Bridge.



FRONT VIEW

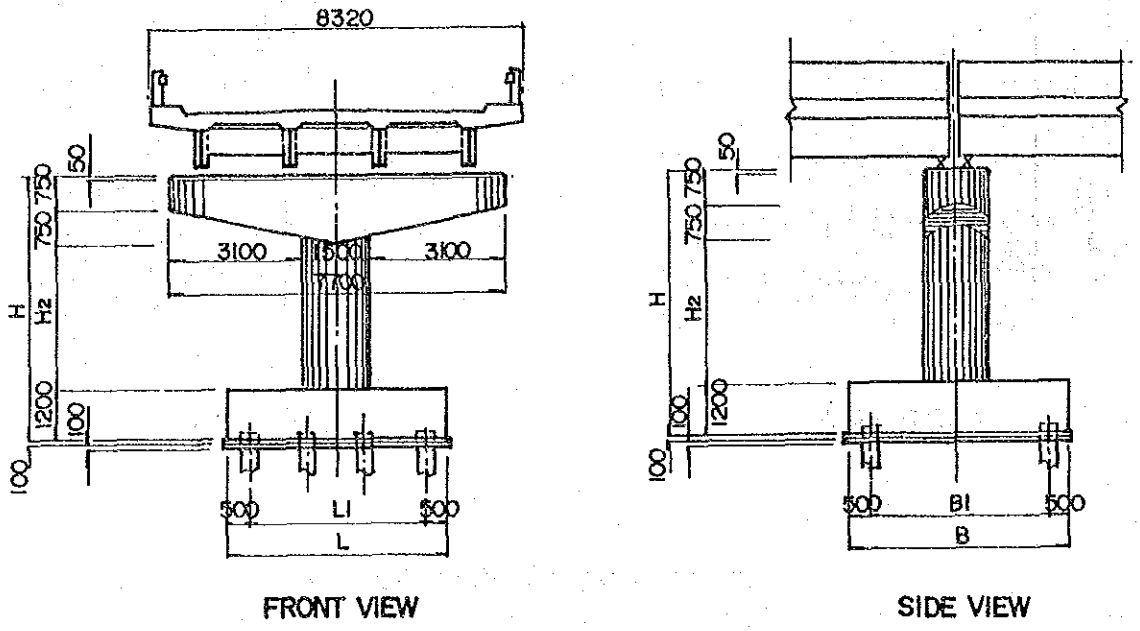


SIDE VIEW

ABUTMENT ON PILE FOUNDATION

BRIDGE NO.	NAME OF BRIDGE		HEIGHT (m)				WIDTH (m)			PILE LENGTH(m) x No.
			H	H1	H2	H3	B	B1	B2	
03.S	APOLLO	A	4.50	1.25	2.25	1.00	2.50	1.00	0.30	13.0 x 10
		B	4.00	1.25	1.75	1.00	2.50	1.00	0.30	14.0 x 10

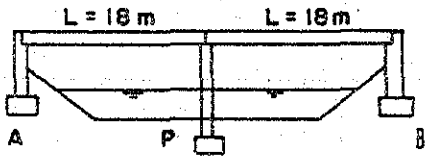
Figure 5.3-3 (1/2)



PIER ON PILE FOUNDATION

Figure 5.3-3 (2/2) TYPICAL PIER (SPAN LENGTH; 18 m)

Table 5.3-4 SUMMARY OF BRIDGES

Bridge No.	Name of Bridge	Type of Bridge	Superstructure	Substructure	Remarks
03.S	Apollo Bridge		H-beam L; 18 + 18 = 36m	A.Abut-RC Pile (400mm x 400mm x 13m x 10 piles) P.Pier-RC Pile (400mm x 400mm x 17m x 10 piles) B.Abut-RC Pile (400mm x 400mm x 14m x 10 piles)	

5.3.4 Design of Superstructures

(1) Design Criteria

The design criteria for superstructures, as adopted for the Substitute Bridge, is same as the prior Basic Design Study Report (Phase III).

(2) Design of Superstructures

The result of the analysis are given in the following tables:

1) Size and stress intensity of girders - Table 5.3-5
2) Size of slabs, girders and shoes - Table 5.3-6

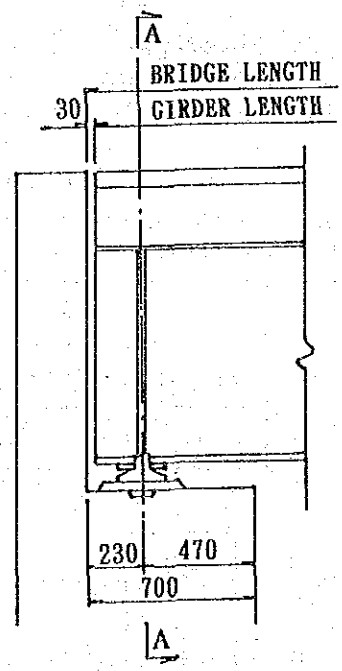
Table 5.3-5 SIZE AND STRESS INTENSITY OF THE GIRDER FOR SUBSTITUTE BRIDGE

SPAN LENGTH (m)			18
CARRIAGEWAY (m)			6.7
TYPE			H-beam
GIRDER HEIGHT (m)			H792 x 300
TYPE OF STEEL MATERIALS			SMA50
SECTION	PRINCIPAL MOMENT OF INERTIA (cm^4)		254.000
	SECTION MODULUS (cm^3)		243.4
	SECTION MODULUS (cm^3)		6.410
BENDING MOMENT	LOADING	(t m)	153.2
BENDING STRESS	STRESS	(kg/cm^2)	1,991
	ALLOWABLE STRESS	(kg/cm^2)	2,100
SHEARING	LOADING	(t)	35.6
SHEARING STRESS	STRESS	(kg/cm^2)	340
	ALLOWABLE STRESS	(kg/cm^2)	1,200
DEFLECTION	DEFLECTION	(kg/cm^2)	$\frac{1}{1,208}$
	ALLOWABLE DEFLECTION		$\frac{1}{1,111}$

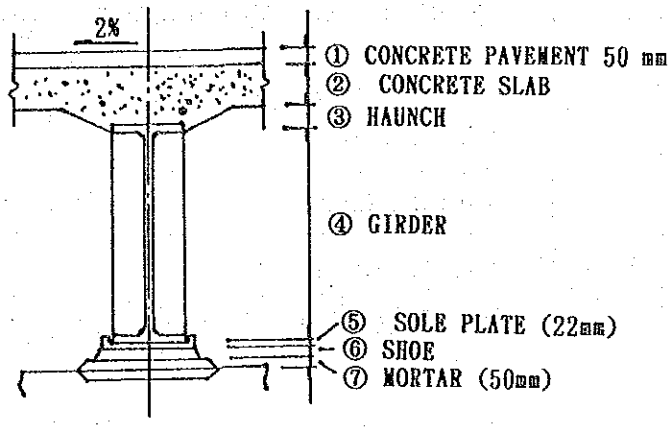
Table 5.3-6 SIZE OF SLABS, GIRDERS AND SHOES

Span Length (m)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Shoe	Total (mm)
18	50	180	70+(20)	792	22	63	50	45	1,247

Note: Total height (mm) shows heights of bridge center



SIDE VIEW



A-A SECTION

5.3.5 Design of Substructures

(1) Design Criteria

The design criteria for superstructures, as adopted for the substitute bridge, is same as the prior Basic Design Study Report (Phase III).

(2) Design of Substructures

Table 5.3-7 shows the result of reaction and design reaction of abutments. And Table 5.3-8 shows substructure types and reaction of pile.

Table 5.3-7 REACTION AND DESIGN REACTION OF ABUTMENTS

(Unit: ton)

Span	Normal Condition			Seismic Condition			
	Vertical Condition			Longitudinal		Lateral	
	Dead L.	Live L.	Total	Vertical	Horizontal	Vertical	Horizontal
18	67.6	57.4	125.0	67.6	16.2	67.6	8.1

Span (m)	Live Load (t)	Ratio of Inter Girder/Out Girder	Impact	G1 (t)	G2 (t)
18	57.4	1.190	0.272	16.7	19.8

Note: Reaction of G1 & G2 includes Impact

Table 5.3-8 SUBSTRUCTURE TYPES AND REACTION OF PILE

Bridge No. and Name	Body	Span Length	Bear-ing	Body height	Body width	No. of Pile	Reaction of Pile						Allowable Horizontal Force (t)			
							Normal Condition (t/pile)			Siesmic Condition (t/pile)			N-value	Type of Pile	Normal Condi-tion (ha)	Siesmic Condi-tion (ha)
							Max	Min	H	Max	Min	H				
03.S Apollo Bridge	A	18	Fix	4.5	2.5	10	33.4	25.6	5.3	43.9	0.7	8.6	5	a	45	65
	P	18+18	F.E.	5.5	3.0	8	42.9	-	-	43.3	11.4	3.4	5	b	45	65
	B	18	Fix	4.0	2.5	10	29.2	25.6	4.1	26.1	15.2	7.6	5	a	45	60

A: Abutment of 1st Approach road side
P: Pier
B: Abutment of 2nd Approach road side
a: ø 30 m/m
b: ø 25 m/m

5.3.6 Design of Approach Roads

Design Criteria

The design standard of the approach roads is same as the prior Basic Design Study Report (Phase III) which was submitted to the Government of Philippines on March 1990.

5.3.7 Design of Pavement Structures

(1) Design Criteria and Types of Pavement

Design criteria and types of pavement are same as the prior Basic Design Study Report (Phase III).

(2) Standared Pavement Structure

Since the length of roads to be constructed under the Project is short, Portland Cement Concrete (PCC) pavement is recommended, as shown in Figure 5.3-4.

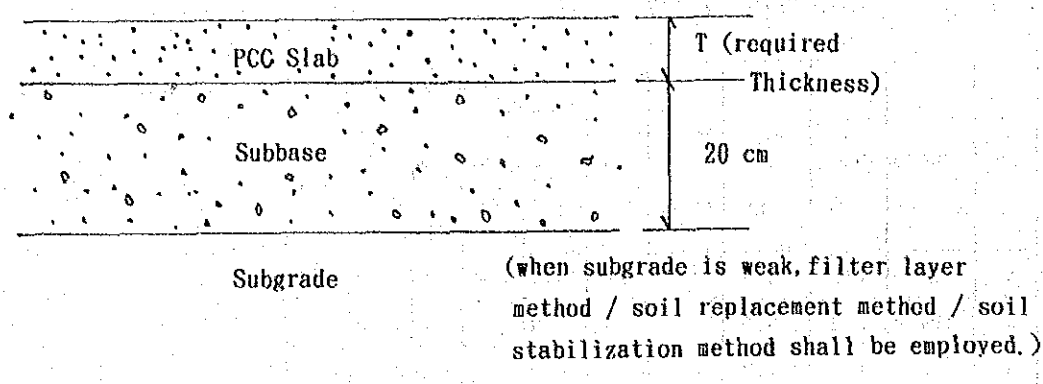


Figure 5.3-5 TYPICAL CROSS SECTION OF PCC PAVEMENT

5.3.8 Design of River Protection

(1) Required Area of Water Opening

Apollo Bridge is located at a part of bending areas so that the river width is narrow. It is better to cut a part of riverbank of upstream side in order to let mudflow run out smoothly.

(2) Type of River Bank Protection

Type of river bank protection is same as the prior Basic Design Study Report (Phase III).

5.3.9 Construction Method

(1) Transportation of Steel Materials

Steel materials supplied by Japan Grant Aid will be shipped by sea from Japan to ports of entry in the Philippines, and then delivered to bridge construction sites by land. The transportation routes and existing conditions of the roads are presented in Table 5.3-9.

As described in the Minutes of Discussions, the Philippine Government will keep the access roads including bridges therein to the following bridge sites passable for the transport of

materials and equipment.

Table 5.3-9 TRANSPORTATION ROUTE AND EXISTING CONDITION OF THE ROADS

Bridge No.	Name of Bridge	Port of Landing	Island Route		Existing Condition Land Route
			Sea Route	Land Route	
03.S	Apollo Bridge	Manila	none	Manila - Site 107 km from Manila	·Paved good condition

(2) Erection of Steel Girder

Generally, the methods which can be adopted to erect the steel girder include the direct erection method by the use of a crawler crane, and launching method by cantilever.

It is better to adopt the suitable methods considering the magnitude of construction and other conditions. In this study, the direct erection method is adopted. (Refer to Figure 5.3-5).

Apollo bridge will be constructed by using temporary embankment considering the shallow water depth.

With this method, bents are required to hold steel girder while erecting. Coconut trees which are available will be used instead of steel bents. Since it is difficult to bend saddles on the riverbeds during the rainy season, it is planned to drive coconut tree piles into the riverbed during the dry season, and the piles can serve as erection girders even during the rainy season.

Table 5.3-10 shows the plan of erection method for the steel girder and construction yard and Figure 5.3-6 shows direct erection method, Figure 5.3-7 shows timber detour bridge and Figure 5.3-8 shows the typical section of wooden bents.

Table 5.3-10 PLAN OF ERECTION METHOD FOR THE STEEL GIRDER AND CONSTRUCTION YARD

Bridge No.	Name of Bridge	Steel Girder		Method of Erection	Type of Bent	Type of Yard	Remarks
		Type	No. of Joint				
03.S	Apollo Bridge	H-Beam L=2@18 m=36m	6	Bent by crawler crane	Wooden bent	Filled cofferdam	-

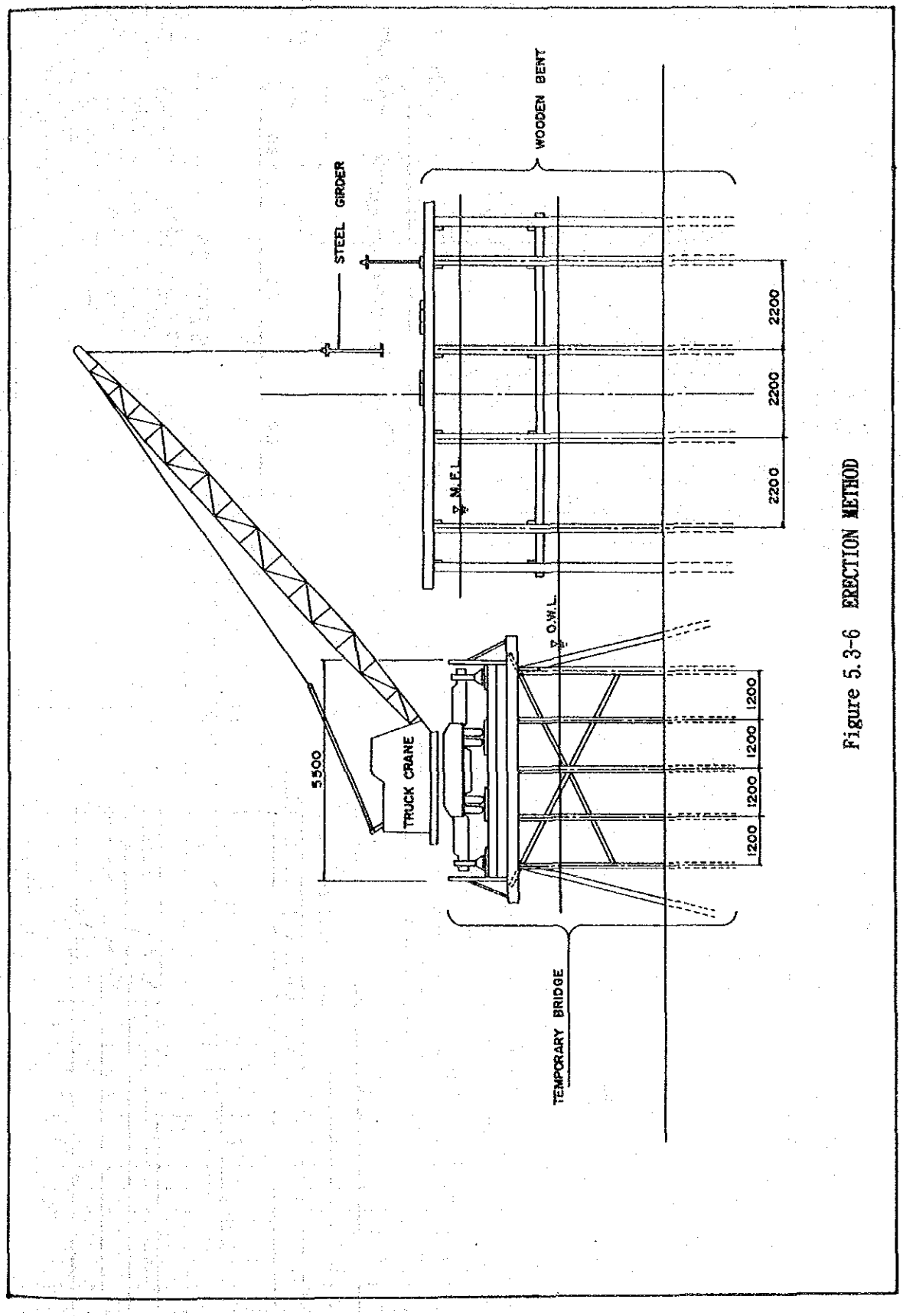
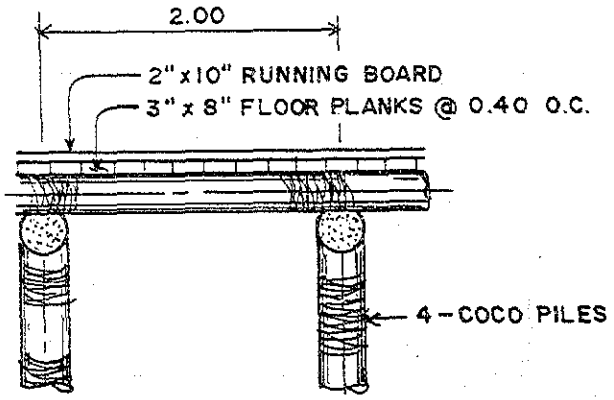
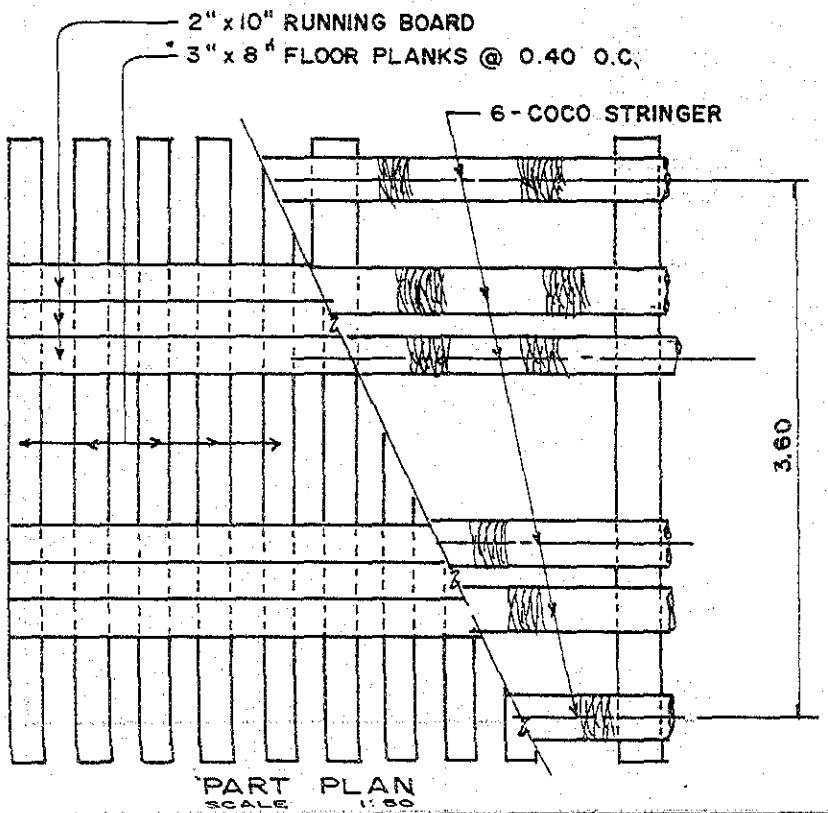


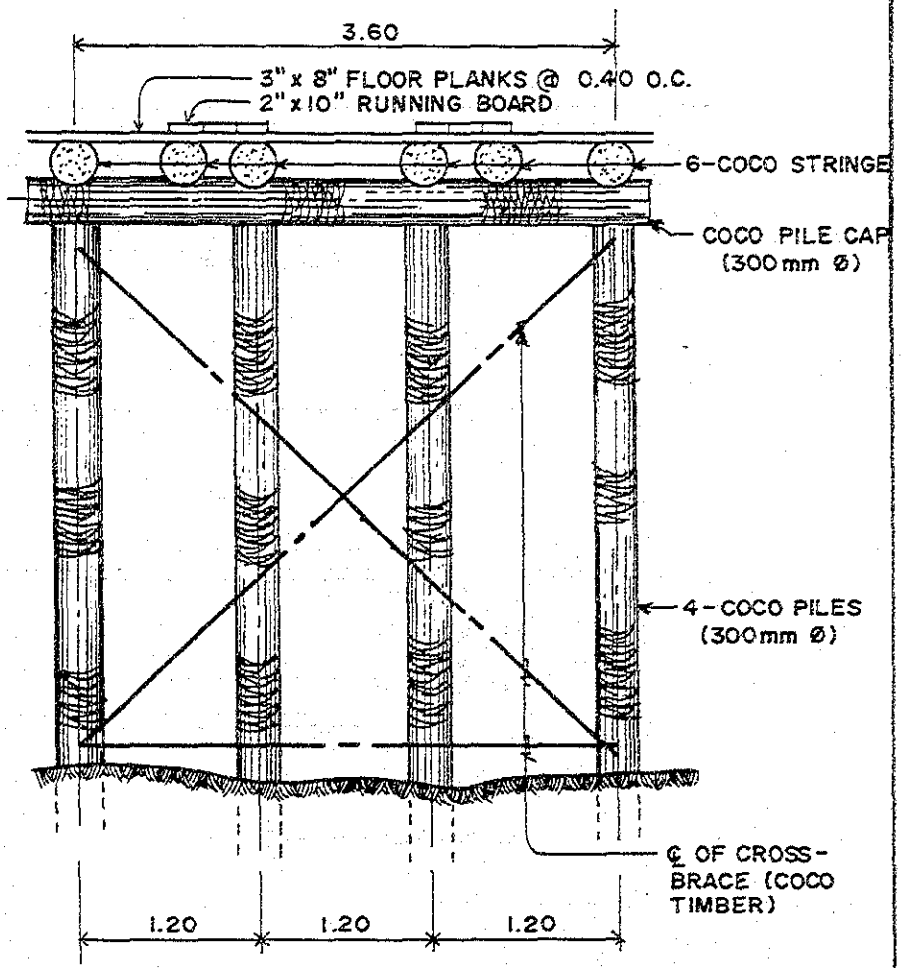
Figure 5.3-6 ERECTION METHOD



PART ELEVATION
SCALE . 1:50

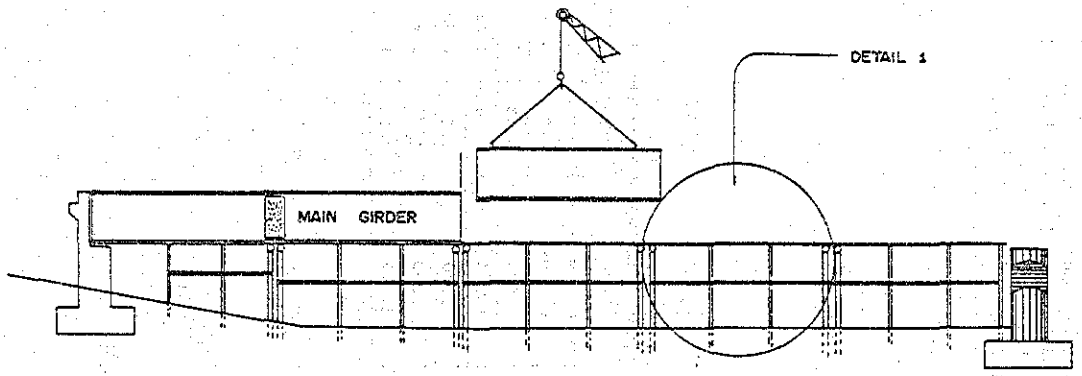


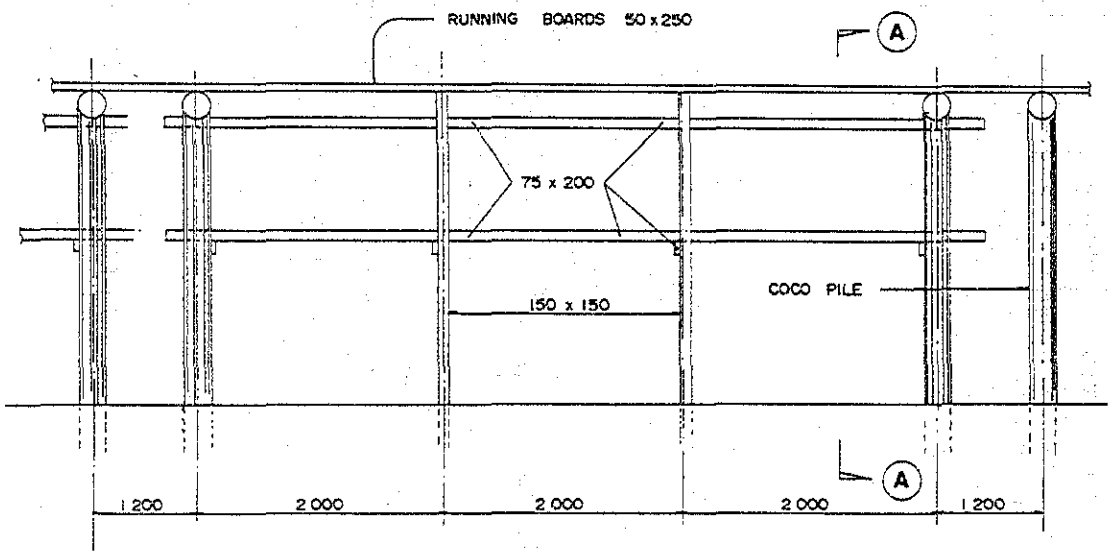
PART PLAN
SCALE 1:50



SECTION
SCALE 1:50

Figure 5.3-7 TYPICAL SECTION OF WOODEN BENTS

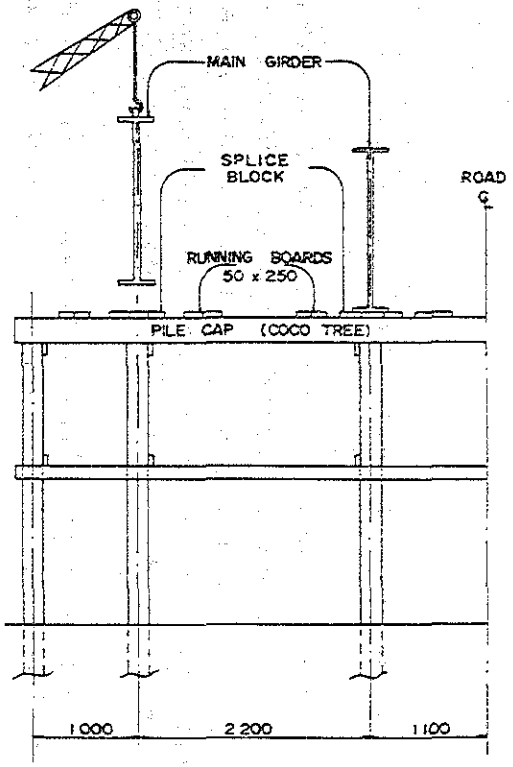




DETAIL 1

BILL OF MATERIAL FOR WOODEN BENT
FOR 7 m. LENGTH

REMARKS	NO.	SIZE	LENGTH	QUANTITY
COCO PILE	12	ø200	5 000	1.884 m^3
PILE CAP	2	ø200	9 200	0.578 m^3
HORIZONTAL BRACE	12	75x200	7 000	1.260 m^3
HORIZONTAL BRACE	4	75x200	9 200	0.552 m^3
RUNNING BOARD	16	50x250	7 000	1.400 m^3
LUMBER PILE	16	150x150	5 000	1.800 m^3



SECTION A-A

Figure 5.3-8 TIMBER DETOUR BRIDGE

(3) Construction of Cofferdams

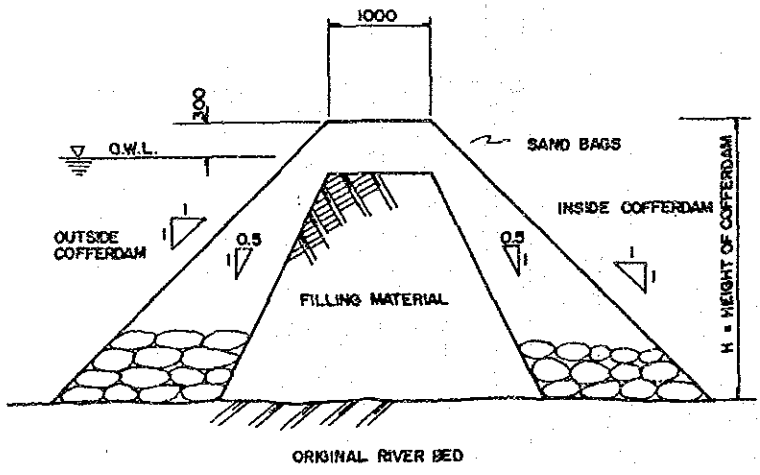
Construction of substructures and river protection is planned to be implemented during the dry season because this means not only reducing construction costs but also the safety and quality of construction. However, where the ordinary water level is high, temporary cofferdams will be needed.

As the type of cofferdams, temporary cofferdams type is planned to be implemented. The temporary cofferdams is shown in Figure 5.3-9.

Table 5.3-11 shows the plan of temporary cofferdams for the substructure and river bank protection.

Table 5.3-11 PLANNING OF COFFERDAM

Bridge No.	Name of Bridge	Abutment A1	Abutment A2	Pier P1	River Bank A1 Protection	River Bank A2 Protection
03.S	Apollo Bridge	Filled cofferdam	Filled cofferdam	Filled cofferdam	Filled cofferdam	Filled cofferdam



BILL OF MATERIALS FOR COFFERDAM FOR 1 m LENGTH

HEIGHT OF COFFERDAM H (mm)	SAND BAGS (m^3)	FILL (m^3)
500	0.75	0
1,000	1.38	0.63
1,100	1.53	1.78
1,200	1.70	0.95
1,300	1.87	1.12

Figure 5.3-9 FILLED COFFERDAM

(4) Traffic During Construction

New bridge is planned to construct beside existing bridge downstream so that the existing bridge will be used for traffic during construction.

(5) Demolition of Existing Bridge

Existing bridge will be demolished after completion of construction by the Philippine side, also by the Philippine side.

5.3.10 Construction Condition and Attention Matters in relation with the Construction

General condition, regional feature and attention matters in relation with this project are as follows.

- Weather condition in the project site.
  The project area is located southwest of Metro Manila.
  Weather condition is as follows.

  - There are two pronounced seasons, dry from November to April and wet for the rest of the year.

  - The frequency of typhoon is 10 to 12 times for one year.

The working ratio depends on to the weather condition of the area because of the work inside the river. As a result, it is desirable to construct the substructure, riverbank protection and approach roads during dry season.

- Location of bridge planned

  The location of the construction bridge is decided to be on the downstream side based on the road alignment, safety of traffic flow and land acquisition. As a result, the necessary attention matters for the work are as follows.

  - To use the existing bridge as the detour during construction.

  - It is necessary to remove the existing bridge after completing the work.

5.4 Implementation Schedule

The implementation schedule of 10 subjective bridges for Phase III, Group 2 should consider several factors, especially the timing of dry season (November to April), and rainy season (May to October).

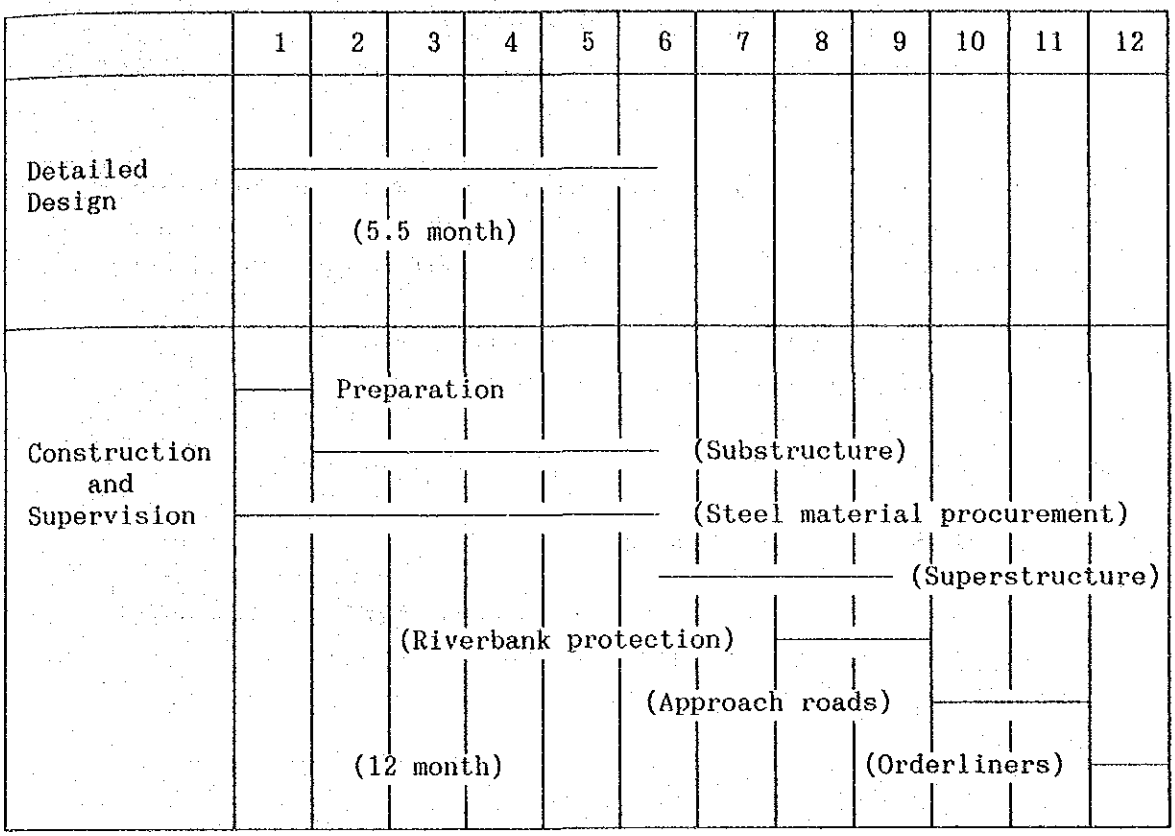
The construction schedule, especially for the piers inside rivers, should be executed during the dry season; otherwise, the use of cofferdams may be required. Soil compaction for the embankments of approach roads is also recommended to be done during the dry season.

Based on the above conditions, construction is scheduled as follows.

- Detailed design: 5.5 months
- Construction period: 12 months
- Dry season: Nov. - Apr.
- Rainy season: May - Oct.

The proposed implementation schedule is shown in Table 5.4-1.

Table 5.4-1 PROJECT IMPLEMENTATION SCHEDULE



5.4.1 Scope of Work

(1) Scope of Grant Aid by the Government of Japan

The scope of Grant Aid by the Government of Japan for the Phase III, Group 2 bridges covers construction of bridges, access roads and related structures, including the supply of steel materials. The major construction works are as follows:

a) Construction of Superstructures

. Supply, delivery and erection of steel materials, construction of concrete slabs and handrails.

b) Construction of Substructures

. Construction of abutments and piers (including piles)

. Temporary works (sheet pile cofferdams)

c) Construction of Approach Roads
(Scope is limited to connecting new bridges to existing roads with smooth alignment.)

. Earth works and construction of pavement structures
. Installation of drainage facilities
. Supply, delivery and installation of steel railings

d) Construction of River Bank Protection
(Scope is limited to abutments)

(2) Undertaking of the Government of Philippines

1) Scope of Major Undertakings

a) To ensure the exemption of custom duties, internal taxes and other fiscal levies for the supply of materials under Japan's Grant Aid.

b) To acquire the right-of-way and to provide necessary land area for the construction works.

c) To demolish obstacles including houses within the right-of-way that affect the implementation of the Project.

d) To make passable all roads and bridges leading to the project sites for the transportation of materials and equipment provided under Japan's Grant Aid.

e) To demolish obstacle existing bridge and relocation of incidental facilities.

2) Land Acquisition and Obstacle Demolition

The acquisition of right-of-way, the demolition of obstacles including houses and the temporary provision of necessary land area for construction works are shown in Appendix 10.

(3) Demolish of existing bridge

CHAPTER 6

PROJECT EVALUATION AND CONCLUSION

CHAPTER 6

PROJECT EVALUATION AND CONCLUSION

The Project for Constructing Bridges along Rural Roads (Phase III) aims at implementing the infrastructure in order to promote the activation of socio-economic in the region, as the continuous project of Phase I implemented on Jan. 1988 and Phase II on June 1988. The Government of the Philippines considers the project should be executed.

The direct and indirect effects and extents of improving present situation by the excution of the Apollo Bridge which is a substitute bridge of the Dolores Bridge is as follows.

Table 6-1 EFFECT AND EXTENT OF IMPROVING PRESENT SITUATION BY IMPLEMENTING THE PROJECT

Present Condition and Problems	Proposed Measures	Effect and Improvement Level by the Project
1. The road along the proposed bridge is important for living and transportation of agriculture product. But this bridge is made by timer, and it caused by traffic obstacle.	. To construct a permanent bridge	. It is possible to secure safe and reliable traffic measures, and to transport the agricultural product and necessities of life, anytime, safely and rapidly.
2. Existing bridge has a danger to be washed out and damaged.	. To construct a permanent bridge and execute the design of pier and abutment in consideration of flood countermeasures and to set up riprap.	. It is possible to provide a safe and strong structure except abnormal flooding.
3. The improvement of residential living standard and activation of regional industry are not achieved due to undeveloped road network.	. To accelate the development of neighboring road network by the Government of the Philippines, due to reconstruct a new parmanent bridge.	. Contribution to upgrade the life standard and to promote agriculture and socio-economical activities. . The number of the beneficiary is 15,000 people. The areas of beneficiary is 400 square kilometers.

As describing above, this project will contribute the rise of living standard, and promote the productivity of agriculture. As a result, it is judged proper to execute this project under Japan Grant Aid. Further, it is considerable that the Government of the Philippines can cope with executing the maintenance and management for the bridge completed based on the results of Phase I and Phase II.

APPENDICES

1. Member List of the Basic Design Team
2. Survey Schedule
3. Member List of Concerning Party
4. Minutes of Discussion
5. List of Requested Bridges
6. List of Collected Data
7. Country Data
8. Hydrological Analysis
9. River and Sabo Study
10. Cost Shouldered by the Government of Republic of the Philippines
11. Recommendation for Group 1, Phase III
12. General Plan of Bridges
13. Data of Topographic Survey
14. Data of Geotechnical Survey
15. Photo Album

APPENDIX 1

MEMBER LIST OF THE BASIC DESIGN STUDY TEAM

1. NAME OF BASIC DESIGN STUDY TEAM FOR FIELD SURVEY

MEMBERS OF THE FIELD SURVEY TEAM

Michio Okahara

Leader
Chief, Foundation Engineering Division,
Structure and Bridge Department,
Public Works Research Institute,
Ministry of Construction.

Satoru Watanabe

Project Coordinator
Second Basic Design Study Division, Grant Aid Planning & Survey Department, JICA.

Tsuneo Bekki

Bridge Planner
Katahira & Engineers International

Mitsumasa Mitani

Bridge Designer
Katahira & Engineers International

Keiji Sasabe

Hydrologist
Construction Technic Institute Engineering Inc.

Koichi Kadoya

Construction Planning
Katahira & Engineers International

Kenji Sugawara

Geotechnical/Topographical Surveyor,
Katahira & Engineers International

APPENDIX 2

SURVEY SCHEDULE

1. ITINERARY OF THE BASIC DESIGN STUDY TEAM

Survey schedule of the study team from September 18th, 1991 to November 1st, 1991 is as follows.

No.	Date	Activities	Geological Survey	Topographic Survey
1.	Sep. 18, 1991 (Wed.)	·Mitumasa Mitani Keiji Sasabe Kenji Sugawara Arrival to Metro Manila ·Courtesy call to JICA ·Courtesy call to Embassy of Japan		
2.	Sep. 19, 1991 (Thu.)	·Meeting with DPWH Explanation of Inception Report, Survey Schedule, Questionnaire, and Japan's Grant Aid ·Collection of Data		
3.	Sep. 20, 1991 (Fri.)	·Site Investigation 03.10 Dolores Br. (Group 2) 03.08 Pias Br. (Group 1) 03.11 Pulo Br. (Group 1) 03.03 Bacong Br. (Group 2) 03.02 Aeta Kinarangan (substitute)		
4.	Sep. 21, 1991 (Sat.)	·Site Investigation 03.18 Sindol Br. (Group 1) 01.02 Maphilindo Br. (Group 2) 03.17 Sula Br. (Group 2)		
5.	Sep. 22, 1991 (Sun.)	·Site Investigation Inspection of Infrastructure damaged in Angeles city and San Fernando city		
6.	Sep. 23, 1991 (Mon.)	·Site Investigation 03.05 Dagat-Dagatan Br. (Substitute Candidate Br.) 03.S Apollo Br. (Substitute Candidate Br.)		
7.	Sep. 24, 1991 (Tue.)	·Review/analysis of collected data ·Discussion among Study Team		

No.	Date	Activities	Geological Survey	Topographic Survey
8.	Sep. 25, 1991 (Wed.)	·Site Investigation 03.07 San Roque Br. (Group 2) ·Discussion among Study Team ·Review/analysis of collected data ·Meeting at JICA		
9.	Sep. 26, 1991 (Thu.)	·Discussion among Study Team ·Review/analysis of collected data ·Hydrological analysis		
10.	Sep. 27, 1991 (Fri.)	·Discussion among Study Team ·Review/analysis of collected data ·Hydrological analysis		
11.	Sep. 28, 1991 (Sat.)	·Site Investigation 04.15a Kinalapan Br. (Substitute candidate Br.) ·Review/analysis of collected data ·Hydrological analysis		
12.	Sep. 29, 1991 (Sun.)	·Review/analysis of collected data ·Discussion among Study Team ·Hydrological analysis		
13.	Sep. 30, 1991 (Mon.)	·Analysis of collected data ·Discussion among Study Team ·Hydrological analysis		
14.	Oct. 1, 1991 (Tue.)	·Site Investigation 04.03 Paurungan Br. (Substitute candidate Br.) ·Analysis of collected data ·Hydrological analysis		
15.	Oct. 2, 1991 (Wed.)	·Analysis of collected data ·Messrs. Mitani, Sasabe and Sugawara Site Survey ·Instruction and Supervision of Geological Survey Bridge No. 03.S Apollo Bridge	Commencement of Survey Bridge No. 04.12a, No. 03.05 and No. 03.S	Commencement of Survey Bridge No. 03.S

No.	Date	Activities	Geological Survey	Topographic Survey
16.	Oct. 3, 1991 (Thu.)	·Analysis of collected data ·Mesers. Mitani, Sasabe and Sugawara Site Survey ·Instruction and Supervision of Geological Survey and Topographic Survey Bridge No. 03.05 Dagat-Dagatan Br. ·Hydrological analysis	Bridge No. 04.12a Bridge No. 03.05 Bridge No. 03.S	Bridge No. 03.S
17.	Oct. 4, 1991 (Fri.)	·Messrs. Mitani, Sasabe and Sugawara Site Survey ·Instruction and Supervision of Bridge No. 04.12a ·Analysis of collected data ·Hydrolic analysis	Bridge No. 04.12 Bridge No. 03.35 Bridge No. 03.S	Bridge No. 03.S Commencement of Bridge No. 03.05
18.	Oct. 5, 1991 (Sat.)	·Basic planning of the bridges ·Mr. Sugawara Confirmation of conclusion of topographic survey of bridge No. 03.S ·Hydrological analysis	Bridge No. 04.12a Bridge No. 03.05 Bridge No. 03.S	Conclusion of Bridge No. 03.S Bridge No. 03.05
19.	Oct. 6, 1991 (Sun.)	·Basic planning of the bridges ·Mr. Sugawara, instruction and supervision of geological survey and topographic survey of bridge No. 03.05 ·Hydrological analysis	Bridge No. 04.12 Bridge No. 03.05	Bridge No. 03.05
20.	Oct. 7, 1991 (Mon.)	·Basic Planning of the bridges ·Mr. Sugawara Instruction and supervision of geological survey and topographic survey or Bridge No. 04.12a	Bridge No. 04.12a Bridge NO. 03.05 bridge No. 03.S	Bridge commencement of bridge No. 04.12a

No.	Date	Activities	Geological Survey	Topographic Survey
21.	Oct. 8, 1991 (Tue.)	·Basic Planning of the bridges ·Mr. Sugawara Instruction and supervision of geological survey of Bridge No. 03.05 and confirmation of topographic survey of Bridge No. 03.05 ·Hydrological analysis	Bridge No. 04.12a Bridge No. 03.05 Bridge No. 03.S	Conclusion of Bridge No. 04.12a
22.	Oct. 9, 1991 (Wed.)	·Basic Planning of the bridges ·Mr. Sugawara confirmation of geological survey of Bridge No. 03.05	Bridge No. 04.12a Bridge NO. 03.05 bridge No. 03.S	Bridge No. 04.12a
23.	Oct. 10, 1991 (Thu.)	·Basic Planning of the bridges ·Mr. Sugawara confirmation of geological survey of bridge No. 03.S		Conclusion of bridge No. 04.12a
24.	Oct. 11, 1991 (Fri.)	·Basic planning of the bridge ·Analysis of results of geological survey and topographic survey ·Hydrological analysis		
25.	Oct. 12, 1991 (Sat.)	·Preparing, the drawings of general view for substitute candidate bridges ·Review/analysis of results of geological survey and topographic survey ·Hydrological analysis		
26.	Oct. 13, 1991 (Sun.)	·Preparing the drawings of general view for substitute candidate bridges ·Review/analysis of results of geological survey and topographic survey. ·Hydrological analysis		
27.	Oct. 14, 1991 (Mon.)	·Preparing the drawings of general view for substitute candidate bridges ·Review/analysis of results of geological survey and topographic survey. ·Hydrological analysis		

No.	Date	Activities	Geological Survey	Topographic Survey
28.	Oct. 15, 1991 (Tue.)	·Preparing the drawings of general view for substitute candidate bridges ·Review/analysis of results of geological survey and topographic survey. ·Hydrological analysis		
29.	Oct. 16, 1991 (Wed.)	·Discussion among Study Team ·Preparation for the drawings of general view for substitute candidate bridges ·Review/analysis of results of geological survey and topographic survey ·Hydrological analysis		
30.	Oct. 17, 1991 (Thu.)	·Mr. Sakabe returned to Japan ·Preparation for the drawings of general view for substitute candidate bridges ·Reviwe/Analysis of results of geological survey and topographic survey		
31.	Oct. 18, 1991 (Fri.)	·Mr. Kadoya arrival to Metro Manila ·Discussion among Study Team ·Preparation for the drawings of general view for substitute candidate bridges ·Review/analysis of results of geological survey and topographic survey		
32.	Oct. 19, 1991 (Sat.)	·Discussion among Study Team ·Review/analysis of collected data ·Preparation for the drawings of general view for substitute candidate bridges ·Review of Executing Planning ·Review/analysis of results of geological survey and topographic survey		
33.	Oct. 20, 1991 (Sun.)	·Review/analysis of collected data ·Preparation for the drawing of general view for substitute candidate bridges ·Review of Executing Planning ·Review/analysis of results of geological survey and topographic survey		
34.	Oct. 21, 1991 (Mon.)	·Review/analysis of collected data ·Preparation for the drawing of general view for substitute candidate bridges ·Review of Executing Planning ·Review/analysis of results of geological survey and topographic survey		

No.	Date	Activities	Geological Survey	Topographic Survey
35.	Oct. 22, 1991 (Tue.)	·Review/analysis of collected data ·Preparation for the drawing of general view for substitute candidate bridges ·Review of Executing Planning ·Review/analysis of results of geological survey and topographic survey		
36.	Oct. 23, 1991 (Wed.)	·Messrs. OKAHARA and WATANABE arrival to Metro Manila ·Meeting at JICA ·Discussing among Study Team ·Review of Executing Planning ·Review/analysis of results of geological survey and topographic survey		
37.	Oct. 24, 1991 (Thu.)	·Meeting at DPWH ·Site Investigation 03.10 Dolores bridge (Group 2) 03.03 Bacong bridge (Group 2) 03.02 Aeta-Kinalangan bridge (Substitute candidate bridge) 03.08 Pias bridge (Group 1) 03.11 Pulo bridge (Group 1) ·Review/analysis of results of geological survey and topographic survey		
38.	Oct. 25, 1991 (Fri.)	·Mr. Sugawara returned to Japan ·Site Investigation 03.18 Sindol bridge (Group 1) 01.02 Maphilindo bridge (Group 2) 03.17 Sula bridge (Group 2)		
39.	Oct. 26, 1991 (Sat.)	·Site Investigation 03.07 San Roque bridge (Substitute candidate bridge) 03.05 Dagat-Dagatan bridge (Substitute candidate bridge) 03.S Apollo bridge (Substitute candidate bridge)		
40.	Oct. 27. 1991 (Sun.)	·Site Investigation 04.12a Tumalim bridge (Substitute candidate bridge) 04.03a Paurungan bridge (Substitute candidate bridge) ·Discussion among Study Team		
41.	Oct. 28, 1991 (Mon.)	·Discussion among Study Team ·Meeting with DPWH ·Review of Executing Planning		

No.	Date	Activities	Geological Survey	Topographic Survey
42.	Oct. 29, 1991 (Tue.)	·Meeting with DPWH ·Discussion among Study Team ·Preparation for minutes of Discussions ·Review of Executing Planning		
43	Oct. 30, 1991 (Wed.)	·Meeting with DPWH ·Minutes signed ·Review of Executing Planning		
44.	Oct. 31, 1991 (Thu)	·reporting to JICA ·review of Executing Planning		
45.	Nov. 1, 1991 (Fri.)	·Metro Manila to Tokyo		

APPENDIX 3

MEMBER LIST OF CONCERNING PARTY

Name and Organization		Position
Department of Public Works and Highways		
Mr. TEODORO T. ENCARNACION	-	Undersecretary
Mr. MANUEL M. BONOAN	-	Assistant Secretary for Planning
Mr. EDILLO MONTEMAYOR	-	Assistant Director, Bureau of Construction
Mr. ANTONINO T. NAGUIT, JR.	-	OIC, Engineer V Bureau of Construction
Ms. LINDA M. TEMPLO	-	Engineer V Planning Service
Mr. JAIME S. MAGNAYA	-	Engineer IV Planning Service
Mr. ADRIANO DOROY	-	Engineer IV Bureau of Design
Mr. DACIANO D. TUBAL	-	Engineer IV Bureau of construction
Mr. TYOJI HAGIWARA	-	JICA Expart
Embassy of Japan in the Philippines		
Mr. TAKUYA IKEDA	-	First Secretary
JICA Office in the Philippines		
Mr. MASATAKA IIJIMA	-	Resident Representative
Mr. KENJI MATSUMOTO	-	Assistant Resident Representative

APPENDIX 4

MINUTES OF DISCUSSION

MINUTES OF DISCUSSIONS

THE SUPPLEMENTARY BASIC DESIGN STUDY ON THE PROJECT

FOR CONSTRUCTING BRIDGES ALONG RURAL ROADS

(PHASE III)

IN THE REPUBLIC OF THE PHILIPPINES

In response to the request of the Government of the Republic of the Philippines, the Government of Japan decided to conduct a Supplementary Basic Design Study on the Project for Constructing Bridges along Rural Roads (Phase III) (hereinafter referred to as "the Project"), and the Japan International Cooperation Agency (hereinafter referred to as "JICA") sent the study team, headed by Dr. Michio Okahara, Chief of Foundation Engineering Division, Structure and Bridge Department, Public Works Research Institute, Ministry of Construction, from 19th September to 1st November 1991.

The team had a series of discussions with the authorities concerned of the Government of the Philippines and conducted a field survey.

As a result of the discussions and field survey, both parties confirmed the main items described on the attached sheets. The team will proceed to the works and prepare the Supplementary Basic Design Study Report.

Manila, 30th October, 1991

DR. MICHIO OKAHARA
Leader
Basic Design Study Team
JICA

MR. TEODORO T. ENCARNACION
Undersecretary
Department of Public Works
and Highways
The Republic of the Philipines

ATTACHMENT

1. Objective of the Supplementary Basic Design Study

The objectives of the study are to re-study 10 bridges under Phase III, Group 2 described in the Basic Design Study Report (March, 1989), particularly 5 bridges which were affected due to the eruption of Mt. Pinatubo, to study 6 candidate bridges requested by the Government of the Philippines, and finally to plan the basic design of bridges under Phase III, Group 2 for Japan's Grant Aid.

2. Executing and Coordinating Agency

The executing agency is the Department of Public Works and Highways.

3. Bridges and Sites under Phase III, Group 2 requested by the Government of the Philippines.

After discussions on the Project, the Dolores Bridge was judged to be excluded because of the effects and/or potential risk of the eruption of Mt. Pinatubo. Instead, the Apollo Bridge was selected among the 6 candidate bridges to replace the Dolores Bridge.

The bridges finally selected under Phase III, Group 2 are shown in Annex 1 and these sites are shown in Annex 2.

However, the final components of the Project may differ from the above, if it is judged necessary after further studies.

4. Grant Aid Programme extended by Japan

1) The Government of the Philippines has understood the system of Japan's Grant Aid explained by the team.

2) The Government of the Philippines will take necessary measures described in Annex 3, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan will be extended to the Project.

5. Bridges under Group 1

1) Both parties agreed that the Government of the Philippines shall complete the construction of the Bridges under Group 1 before July, 1992.

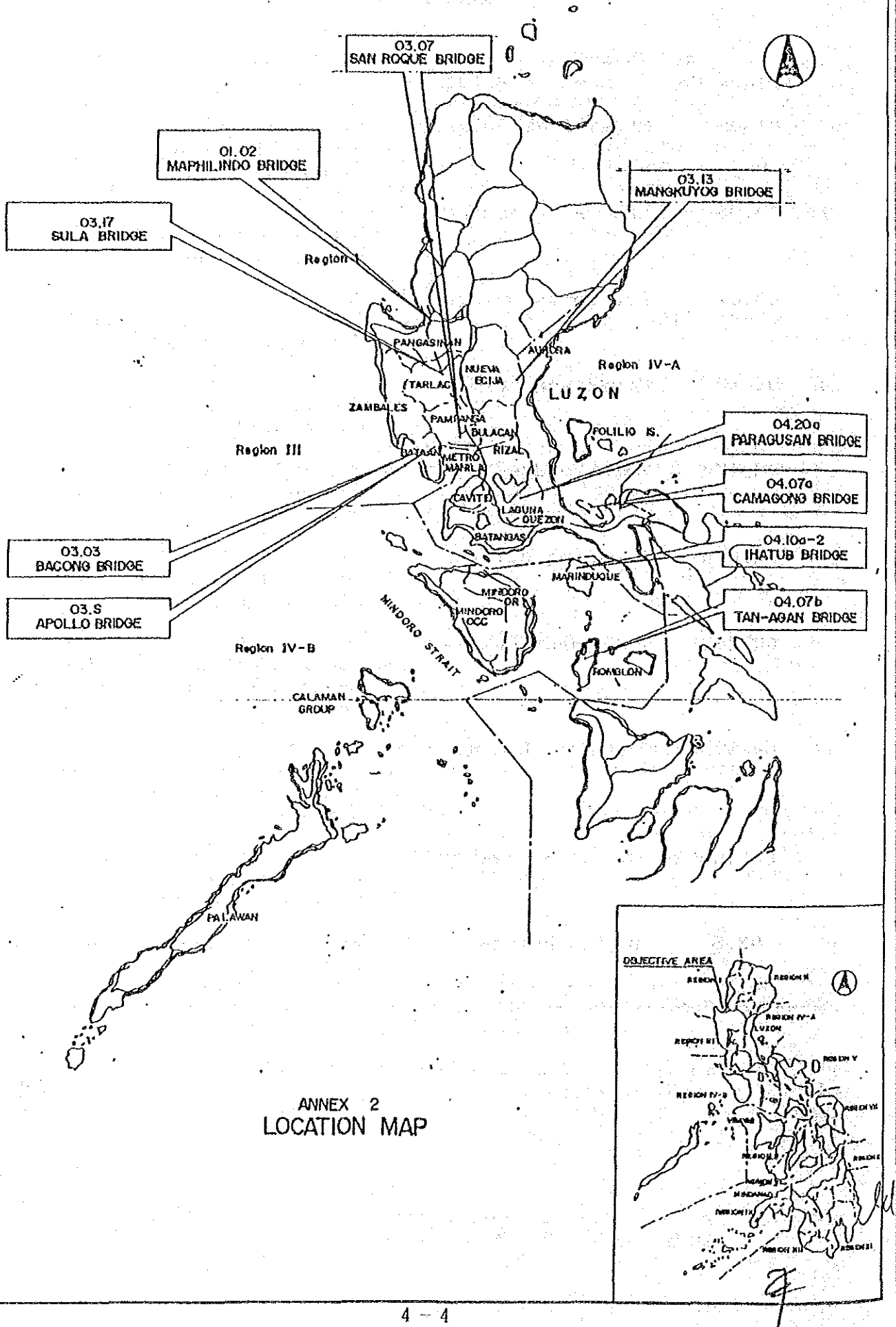
2) The team will recommend the technical advices for the construction of all Bridges under Group 1 affected by the eruption of Mt. Pinatubo in the report of Supplementary Study.

6. Reporting

JICA will complete the final report and send it to the Government of the Philippines by February in 1992.

ANNEX 1

No.	Bridge No.	Name of Bridge	L o c a t i o n
1	01.02	Maphilindo Bridge	Km. 220 + 900 Biec-Lomboy Road Binmaley, Pangasinan
2	03.03	Bacong Bridge	Km. 105 + 360 Luacan-Bacong Road Bacong, Bataan
3	03.07	San Roque Bridge	Km. 57 + 284 San Roque Barangay Road Hagonoy, Bulacan
4	03.13	Mangkuyog Bridge	Km. 169 + 000 Camachile-Bantug Road Nueva Ecija
5	03.17	Sula Bridge	Km. 150 + 000 Tarlac-Sula Road Sula, Tarlac
6	04.07a	Camagong Bridge	Km. 023 + 700 Quezon-Alabat Perez Road Alabat, Quezon
7	04.20a	Paragusan Bridge	Km. 91 + 084 San Pablo-San Isidro Road San Isidro, San Pablo City Laguna
8	04.07b	Tan-Agan Bridge	Km. 11 + 100 Odiongan-San Andres Road Tan-Agan, San Andres Romblon
9	04.10b-2	Ihatub Bridge	Km. 116 + 832.85 Boac-Gasan Road Ihatub, Boac, Marinduque
10	03.S	Apollo Bridge	Brgy. Apollo-St. Joseph Road Brgy. Apollo Orani, Bataan



ANNEX 2
LOCATION MAP

ANNEX 3

NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE PHILIPPINES

1. To acquire the right-of-way and to provide necessary land area for the construction works.

2. To demolish obstacles including houses within the right-of-way that affect the implementation of the Project.

3. To make passable all roads and bridges leading to the Project sites for the transportation of materials and equipment provided under Japan's Grant Aid.

4. To bear the commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

5. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the Project at the port of disembarkation.

6. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into the Philippines and stay therein for the performance of their work.

7. To exempt Japanese nationals engaged in the Project from customs duties, internal tax, other fiscal levies and other administrative requirements which may be imposed in the Philippines with respect to the supply of material and services under the verified contracts.

8. To maintain and use properly and effectively facilities constructed under the Grant Aid.

9. To bear all the expenses, other than those to be borne by the Grant, necessary for the construction of the facilities.

ANNEX 4

LIST OF PARTICIPANTS

I. BASIC DESIGN STUDY TEAM

1.	Dr. MICHIO OKAHARA	- Team Leader
2.	Mr. SATORU WATANABE	- Project Coordinator
3.	Mr. TSUNEO BEKKI	- Bridge Planner
4.	Mr. KOICHI KADOYA	- Construction Planner

II. DPWH PANEL

1.	Mr. TEODORO T. ENCARNACION	- Undersecretary
2.	Mr. MANUEL M. BONOAN	- Assistant Secretary for Planning
3.	Mr. EDILLO MONTEMAYOR	- Assistant Director, Bureau of Construction
4.	Mr. ANTONINO T. NAGUIT, JR.	- OIC, Engineer V Bureau of Construction
5.	Ms. LINDA M. TEMPLO	- Engineer V Planning Service
6.	Mr. JAIME S. MAGNAYE	- Engineer IV Planning Service
7.	Mr. ADRIANO DOROY	- Engineer IV Bureau of Design

APPENDIX 5

LIST OF REQUESTED BRIDGES

LIST OF BRIDGES AFFECTED BY ERUPTION OF MT. PINATUBO

No.	Bridge Number	Name of Bridge	Location	Existing Bridge		Basic Design
				Length (m)	Type	Length (m)
1	03.10	Dolores Bridge	Km. 76+870 Dolores-Del Rosario Road Bacolor Pampanga	24.65	Timber Bridge	24+24=48
2	03.17	Sula Bridge	Km. 143+104 Tarlac-Sula Road Sula, Tarlac, Tarlac	(50.00)	No Existing Bridge	20+20+20=60
3	03.03	Bacong Bridge	Km. 105+360 Luacan-Bacong Road Bacong, Bataan	46.00	Bailey Bridge	26+26=52
4	03.07	San Roque Bridge	Km. 57+284 San Roque Brgy. Road Hagonoy, Bulacan	63.30	Timber Bridge	18+18+18=54
5	01.02	Maphilindo Bridge	Km. 220+900 Biec-Lomboy Road Binmaley, Pangasinan	128.35	Bailey Bridge	32+32+32+32+32=160

LIST OF CANDIDATE BRIDGES FOR SUBSTITUTION

No.	Bridge Number	Name of Bridge	Location	Existing Bridge Length (m)	Existing Bridge Type	Proposed Bridge Length (m)
1	03.05	Dagat-dagatan Bridge	Km. 62+500 San Rafael-Bustos Road San Rafael, Bulacan	46.00	Bailey Bridge	60.00
2	03.02	Aeta-Kinarangan Bridge	Km. 143+654 Aeta-Kinarangan Road Limay, Bataan	18.40	Bailey Bridge	24.00
3	04.12a	Tumalim Bridge	Km. 91+750 Nasugbu-Tagaytay Road Nasugbu, Batangas	53.10	Bailey Bridge	57.00
4	04.15a	Kinalapan Bridge	Km. 233+033 Baler-Aurora Road Pingit, Baler, Aurora	60.00	Timber Bridge	60.00
5	04.03a	Paurungan Bridge	Km. 29+118 Zapote-Salawag-Salitran Road Dasmarinas, Cavite	61.55	Bailey Bridge	65.00

APPENDIX 6

LIST OF COLLECTED DATA

LIST OF DATA COLLECTED FOR SUPPLEMENTARY BASIC DESIGN STUDY

1. Assessment of Damages to Infrastructure caused by the June 1991 Eruption of Mt. Pinatubo, September 1991 DPWH
2. Damages (June 25, 1991) DPWH
3. Main Points of Finding/Recommendation for Urgent Works, September 11 DPWH
4. Mount Pinatubo Rehabilitation Projects Action Program for River Systems, September 10 DPWH
5. Mt. Pinatubo Operations (Status Report as of August 25, 1991) DPWH
6. Mt. Pinatubo Update
7. Operation Pinatubo: Status Report as of August 26, 1991 DPWH
8. Operation Pinatubo: Status Report as of September 16, 1991 DPWH
9. Rehabilitation and Reconstruction Plan for Mt. Pinatubo Eruption Affected Areas (committee on Infrastructure), DPWH, Region III
10. Pinatubo Lahar Hazards Taskforce: PHILVOCS-MGB-UPNINGS-UICDoGS, September 6, 1991
11. Report on the Lahar Warning System in the Areas of Mt. Pinatubo, August 1991, JICA
12. Report on the Lahar Warning System in the Areas of Mt. Pinatubo, September 1991, JICA
13. Situation update on Mt. Pinatubo (As of 240900 H September 1991), RDCC
14. Synopsis of Excess Sedimentation Problem, Mt. Pinatubo Drainages
15. Action Program of DPWH-REGION III on the damages made by Mt. Pinatubo eruption as of September 24, 1991
16. Organizational chart (Staff of DPWH task force of Mt. Pinatubo rehabilitation program 1991)
17. Implementing Agency and Organization
18. Socio-economic condition of the project area
19. Construction condition of the project area
20. Study Report related to Eruption of Mt. Pinatubo
21. 1990 Philippines Almanac
22. 1990 Philippine Statistical Yearbook

APPENDIX 7

COUNTRY DATA

Table 7-1 Main Economic Index

General Outline of the Republic of the Philippines

Capital: Metro Manila
Language: Pilipino, English
GPN per Capita: 590 dollars

Population: 5,736,000
Area: 300,000 km^2
Currency: Philippine Peso

item / unit / year	GNP	Agri-culture	Mining & Industry	Manufac-turing	GNP Deflator	Financial Balance	Against GNP	Lending Rate	Exchange Rate
	Billion Peso	Composition Rate by Economic Activity (%)			1980 = 100	Million Pesos	%	%	Peso = 1$
1970	41.5	37.1	20.8	18.6	29.2	-943.7	-2.27	10.00	5.9044
1975	114.7	28.8	126.7	24.9	58.3	-2,449.0	-2.13	6.00	7.2479
1980	264.6	23.3	27.5	24.4	100.0	1,812.0	0.68	4.54	7.5110
1984	540.5	25.8	27.2	25.4	200.3	3,714.0	0.68	12.11	16.6990
1985	609.5	26.7	26.6	24.7	235.4	4,493.0	0.74	11.50	18.6070
1986	626.7	26.1	26.3	24.7	246.1	-4,313.0	-0.69	9.63	20.3860
1987	-	-	-	-	259.4	-6,920.0	-	9.08	20.5680

Table 7-2 Main Economic Index

item / unit / year	Exports	Imports	Current Balance	Trade Balance	Long-term Capital Balance	Balance	Total Balance	Foreign Money Reserve	Consumer Price Index
	Million US dollar								1980=100
1970	1,142	1,286	-48	-26	130	87	83	251	28.4
1975	2,294	3,776	-923	-1,196	517	-407	-12	1,359	59.2
1980	5,788	8,295	-1,928	-1,939	878	-1,050	891	3,140	100.0
1984	5,322	6,051	-1,268	-679	291	-977	-403	890	206.2
1985	4,544	5,261	-18	-482	3,068	3,050	952	1,116	253.8
1986	4,842	5,394	996	-202	1,298	2,294	1,131	2,527	255.7
1988	5,565	6,811	-539	-1,017	455	-84	-268	2,014	265.4

Source: Handbook of Overseas Economic Cooperation 1989

Table 7-3 External Assistance

(unit: million US dollars)

Item \ Year	1983	1984	1985	1986
Bilateral Aid	358.0	355.4	437.0	886.6
(Highest Country)	(JPN 147.0)	(JPN 160.1)	(JPN 240.0)	(JPN 438.0)
Multilateral Aid	71.0	41.5	49.3	69.3
(Highest Organization)	(ARAB 13.1)	(IDA 10.0)	(IDA 13.0)	(AsDB 29.9)
Total (Including Private Sector)	1,524.0	945.9	635.2	1,118.4

Table 7-4 Japan's Economic Cooperation and Trade

(unit: million US dollars)

Item \ Year		1983	1984	1985	1986	1987
Bilateral ODA (Net)	Grant	61.97	57.68	69.71	80.37	111.79
	(Technical cooperation)	(26.13)	(31.30)	(29.75)	(39.30)	(44.90)
	Loan	85.05	102.39	170.29	357.58	267.59
	Total	147.02	160.07	240.00	437.96	379.38
Others	(Net)	194.19	40.95	-126.26	24.46	-15.76
Total (Net)		341.21	201.02	113.74	462.42	363.62
Export from Japan		36.76	46.46	70.34	64.93	71.33
Import from Japan		61.42	48.93	100.09	63.05	63.47

Source: Handbook of Overseas Economic Cooperation 1989

Table 7-5 Land and Population

(1990)

Region/Province	Land (km^2)	Population (100 psns.)	Density (psns./km^2)
Metro Manila	636.0	7,929	12,467.0
CAR	18,293.6	1,146	62.6
Region 1	12,840.2	3,551	276.6
Region 2	26,837.6	2,341	87.2
Region 3	18,230.8	6,199	340.0
Region 4	46,924.2	8,266	176.2
Region 5	17,632.5	3,910	221.7
Region 6	20.223.2	5,392	266.6
Region 7	14,951.4	4,593	307.2
Region 8	21,432.7	3,055	142.5
Region 9	18,730.1	3,159	168.7
Region 10	28,327.7	3,159	168.7
Region 11	31,692.8	4,457	140.6
Region 12	23,323.2	3,171	136.0
Total	300,000.0	60,685	202.3

Source: 1990 Philippine Statistical Yearbook

Table 7-6 Persons By Industry

(1990)

Industry	Employed Persons (%)	
Agriculture, Forestry, and Fishery	10,185	(45.2)
Mining and Quarrying	133	(0.6)
Manufacturing	2,188	(9.7)
Construction	947	(4.3)
Electricity, Gas, Water and Sanitary Services	91	(0.4)
Transport, Storage and Communication	1,137	(5.0)
Trading	3,145	(14.0)
Finance	444	(2.0)
Services	4,220	(18.7)
Total	22,532	(100%)

Source: 1990 Philippine Statistical Yearbook

Table 7-7 Persons of Major Industries by Region (1989)

(unit: 1000 psns.)

Item \ Region	Region III	Region IV	
Agriculture, Forestry, and Fishery	749	1,019	9,852
Mining and Quarrying	11	10	154
Manufacturing	275	436	2,298
Electricity, Gas, Water and Sanitary Services	6	13	83
Construction	136	172	911
Trading	301	417	3,074
Transport	154	181	1,095
Finance	38	49	398
Services	405	489	3,972
Others	6	0	13
Total	2,082	2,786	21,849

Source: National Statistic Office

Table 7-8 GDP by Industry

(unit: million Pesos)

	1985	1986	1987	1988	1989
Agriculture, Forestry, and Fishery	26,252	27,110	26,834	27,793	28,986
Mining and Quarrying	1,768	1,574	1,547	1,615	1,563
Manufacturing	21,541	21,717	23,076	25,281	26,886
Construction	4,258	3,382	3,987	4,344	4,947
Electricity, Gas, Water and Sanitary Service	1,433	1,723	1,908	1,995	2,137
Transport	4,953	5,105	5,251	5,487	5,761
Trading	14,066	14,337	15,153	15,998	16,795
Finance	4,286	4,831	5,832	6,250	6,843
Service	6,094	6,039	6,106	6,445	6,787
Public	5,253	5,362	5,697	6,242	6,458
Total	89,904	91,180	95,371	101,450	107,143

Table 7-9 Principal Manufacturing Products

(unit: million Pesos)

	1985	1986	1987	1988	1989
Food Manufactures	8,646	8,738	9,368	9,995	10,427
Beverage Industries	796	733	808	844	937
Tobacco Manufactures	970	713	631	717	703
Textile Manufactures	734	891	990	1,001	1,005
Footwear, Wearing Apparel	1,213	1,378	1,412	1,557	1,837
Wood and Cork Products	536	388	416	458	487
Furniture and Fixtures	109	120	138	155	164
Paper and Paper Products	158	172	187	232	292
Publishing and Printing	389	430	460	496	552
Leather and Leather Products	69	63	68	79	96
Rubber Products	281	290	305	346	358
Chemicals and Chemical Products	1,704	1,584	1,328	1,792	1,804
Products of Petroleum and Coal	1,153	1,156	1,230	1,369	1,409
Non-metallic Mineral Products	375	377	399	488	586
Basic Metal Industries	1,070	1,018	1,140	1,312	1,481
Metal Products	746	725	793	885	998
Machinery except Electrical	409	445	480	537	626
Electrical Machinery	1,600	1,913	2,000	2,355	2,364
Transport Equipment	136	135	162	149	267
Miscellaneous Manufactures	447	448	461	479	492
Total	21,541	21,717	23,076	25,281	26,886

Table 7-10 Principal Agricultural Products

(unit: million Pesos)

	1985	1986	1987	1988	1989
Paddy Rice	4,665	4,899	4,513	4,741	4,998
Corn	1,698	1,798	1,872	1,938	1,979
Coconuts	1,420	1,821	1,803	1,634	1,551
Sugarcane	829	775	701	799	894
Banana	931	935	878	853	887
Other Crops	681	6,847	6,607	6,579	6,710
Livestock	2,114	2,283	2,432	2,666	2,942
Poulry Farming	2,576	2,547	2,742	3,055	3,347
Aquaculture	4,422	4,551	4,638	4,834	5,046
Forest Products	706	654	648	689	632
Total	26,525	27,110	26,834	27,793	28,986

Table 7-11 Telecommunication Facilities and Broadcasting Stations

Region	Telephone		Telephone Station	Telex	Facsimile	Radio	Radio Stations
	Line	Exchange					
Metro Manila	62,918	-	21	-	-	1	18,387
Region I	27,924	21	151	5	1	8	1,824
II	4,278	8	111	3	-	1	440
III	35,564	84	109	9	-	5	1,757
IV	33,925	45	219	5	-	32	1,589
V	7,500	15	129	6	1	13	1,763
VI	32,162	16	132	7	2	1	3,107
VII	23,319	10	127	5	1	1	3,962
VIII	4,700	10	145	3	1	6	605
IX	5,737	6	87	3	1	1	1,041
X	6,946	9	111	7	1	8	2,246
XI	20.895	18	98	3	1	-	2,924
XII	1,950	6	103	6	-	-	790
Total	51,818	248	1,544	62	9	76	40,435

Table 7-12 Balance of Payments

Item	1988	1989	1990 (p)
1. Current Transactions			
A. Merchandise Trade			
Exports	7,074	7,821	8,186
Imports	8,159	10,419	12,206
B. Non-merchandise Trade			
Inflow	3,592	4,586	4,836
Outflow	3,672	4,283	4,218
C. Transfer			
Inflow	778	832	717
Outflow	3	2	3
Current Net Inflow (Total)	-390	-1,465	-2,688
2. Non-monetary Capital			
D. Long-term Capital	-519	379	392
E. Direct Investments	986	854	469
F. Short-term Capital	479	385	620
Non-monetary Capital, total	643	1,527	1,490
G. Monetization of Gold	314	288	218
H. Revaluation Adjustments	83	101	797
Total	650	451	-183

Table 7-13 Foreign Trade by Country

The Name of a Country	1988		1989		1990	
	Export	Import	Export	Import	Export	Import
United States of America	1,715,032	2,432,431	1,978,990	2,796,273	2,365,532	3,094,588
Japan	1,421,309	1,420,374	2,043,224	1,585,856	2,232,046	1,615,978
France	121,454	165,309	165,995	152,154	151,222	143,946
West Germany	320,334	297,886	408,287	334,855	532,132	390,373
Holland	127,634	316,051	203,112	329,224	170,221	350,531
England	161,347	327,649	170,817	328,600	247,886	350,531
Kuwait	182,166	6,702	172,272	8,937	194,495	5,507
Saudi Arabia	111,231	49,137	250,839	57,099	546,238	63,951
Indonesia	84,069	27,165	157,826	56,182	181,563	60,937
Malaysia	249,125	116,893	150,272	98,993	272,461	126,805
Singapore	335,120	223,949	492,550	220,795	486,660	239,632
Thailand	51,659	123,344	82,114	154,978	137,176	156,449
China	242,282	66,802	221,105	50,235	162,102	61,764
Australia	282,782	110,601	347,331	124,338	369,435	96,382
Hong Kong	373,863	346,368	481,130	304,784	554,578	330,470
Korea	330,899	160,548	422,859	175,246	477,993	229,504
Taiwan	510,738	200,834	701,799	210,298	805,570	209,263
Canada	80,927	107,712	158,184	127,424	167,490	122,895
Other Countries	3,109,936	574,435	1,810,115	704,811	2,151,560	529,971
Total	8,159,378	7,074,190	10,418,821	7,821,082	12,206,160	8,186,027

Source: 1991 Philippine Statistic Yearbook

Table 7-14 FUNCTIONAL CLASSIFICATION OF NATIONAL GOVERNMENT EXPENDITURES 1987-1992 (Percentage Distribution)

(unit: %)

	Actual Annual Average 1976-85	Estimate 1986	Protections 1987	1988	1989	1990	1991	1992	Annual Average 1987-92
Economic Services	33.0	17.3	19.0	21.6	23.9	26.3	28.4	30.3	25.1
Agriculture	7.3	3.2	3.0	6.7	6.5	7.4	8.2	9.1	6.8
Industry, Trade and Tourism	3.1	0.7	1.4	1.9	2.4	2.8	3.0	3.3	2.5
Utilities and Infrastructure	23.5	13.4	14.6	14.0	15.0	16.1	17.2	17.9	15.8
Social Services	20.2	18.3	21.5	24.5	28.4	31.4	35.7	39.2	30.1
Education	12.3	10.2	11.5	13.2	14.1	14.9	17.1	18.7	15.0
Health	3.9	3.0	3.4	4.2	5.0	6.6	8.2	9.6	6.3
Social Security and Welfare	2.1	4.7	6.2	6.2	6.2	6.3	6.4	6.4	6.2
Housing and community Development	1.9	0.4	0.4	0.0	2.2	3.6	4.0	4.5	2.7
Defence	14.0	8.9	7.3	7.4	8.0	8.4	8.5	8.9	8.1
General Public Services	20.0	10.0	11.3	15.7	14.7	13.7	12.3	9.6	12.9
Debt Services Fund and Net Landing	11.9	47.5	40.0	30.8	25.0	20.2	15.1	12.0	23.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1. For 1987 onwards, this item includes a portion of the external liabilities of government financial instructions to be assumed by the national government. Excludes debt service on liabilities of the Phillipine Vucioar power Plant.

Sources of Basic Data: MBAI and NEDA

APPENDIX 8

HYDROLOGICAL ANALYSIS

1. OPEN CHANNEL HYDRAULICS

The hydraulic design component of this study is concerned with the determination of the different flood levels that might occur in a channel due to a given flood and of the minimum waterway opening under a structure. The different flood levels were determinated by the rating curve computation which is based on Manning's Formula (in metric units):

$$Q = \frac{1}{n} AR^{2/3} S^{1/2}$$

Where:

Q = discharge, m/S
n = Manning's roughness coefficient
A = cross-sectional area, m
R = hydraulic radius

$$\left(\text{equals } \frac{\text{cross sectional area}}{\text{wetter perimeter}}\right)$$

The value of the coefficient "n" was estimated based on information. Assuming uniform to nearly uniform flow, the value of the hydraulic gradient "S" can be considered equal to the average slope of the stream.

For each site, three channel cross-sections were considered: upstream section, bridge point section and downstream section. The selection of the upstream and downstream sections depended on their representativeness to the channel reach under study. Using the energy equation and the results of the rating curve computation, the water depth at the bridge point was obtained.

The results of the hydraulic computation are given in Table 1 while the calculation details are reported separately.

From Table 1, it can be observed that the computed maximum flood level, MFL (computed), and the maximum flood level obtained by field interview, MFL (interview), are not too different, except for Tumalim Bridge.

Table 1 RESULTS OF HYDRAULIC (AND HYDRAULICAL) INVESTIGATIONS

Bridge No.	Name of Bridge	DA (Km^2)	Q (Design)	V (Average) (m/s)	MFL (Computed) (Elev.)	MFL (Inter-view) (Elev.)	MFL (Design) (Elev.)
03.05	Dagat-Dagatan	4.53	116.8	1.94	6.08	6.25	6.25
03.S	Apollo	18.8	191.4	2.16	17.50	18.00	18.00
04.12a	Tumalim	2.30	104.6	1.72	10.25	11.73	11.73

Note:

DA	- Drainage Area
Q (Design)	- Design Discharge
V (Ave.)	- Average Velocity under the Bridge
MFL (Computed)	- Maximum Flood Level (50-year Frequency)
MFL (Interview)	- Maximum Flood Level on Field Interview
MFL (Design)	- Maximum Flood Level for Design of Bridge

Table 2 HYDROLOGICAL DATA

Bridge No.	Name of Bridge	Location of Bridge	HWL/MFL (m)		LWL/OWL (m)		High Tide (m)	Difference in Height Tempo-rary Bench Marks (m) (Study Team)
			DPWH (1)	Study Team (2)	DPWH (1)	Study Team (2)		
03.05	Dagat-Dagatan	San Rafael-Bustos Rd. San Rafael, Bulacan	7.65	6.25	5.5	-	-	-
03.S	Apollo	Orani Town Proper, Orani, Bataan	-	18.00	-	-	-	-
04.12a	Tumalim	Banilad-Tumalim-M. Indang Road, Nasugbu, Batangas	-	11.73	-	-	-	-