CHAPTER 5 BASIC DESIGN

GROUP I

CHAPTER 5 BASIC DESIGN (Group I)

5.1 Basic Principles

(1) Basic Conditions of the Project

The basic conditions of the project are as follows:

- All bridges are divided into two groups:

  Group I : Subject of applying the steel materials supplied by Japan

  Group II: Subject of construction by Japan under Grant Aid

  Bridges in Group I are the responsibility of Thailand in terms of design, construction and erection of the superstructures (including the construction of approaching roads and bridge concrete decks). For these purposes, the procurement of local materials and equipment is necessary.

- Each group is further divided into two construction phases: Phase I and Phase II. Each phase must be completed within one year. The construction period of Group I starts from the date the Grant Aid materials arrive in Bangkok port.

- The climate is divided into a rainy season and a dry season, which will restrict the construction period. A proper method of execution should be considered in advance.

- Bridges are scattered throughout the northeast region in Thailand which makes it difficult to obtain good quality concrete and to ensure quality control.

(2) Superstructure

1) Adoption of Non-Composite and Simple-support Girders

PWD has little experience with steel structures. Therefore, non-composite and simple-support girders have been adopted.

2) Adoption of Weathering Steel

Weathering steel (SMA --- W) has been adopted because it is maintenance free. Though the color of the steel is limited to dark brown only, it matches the color of laterite pavement.

(3) Substructure

In accordance with the policy of conforming to the structural standards used in Thailand, the following have been selected.

- Abutment: The T type or standard pile bent type can be adopted.
- Pier: Standard pile bent type shall be adopted in cases where the height above the river bed is less than 7 m. For the heights exceeding 7 m, a shallow support layer or spread foundation, the wall type or the column type shall be used.
- Foundation Pile: Standard pile,
  RC Type 350 x 350, 400 x 400

(4) Bridge Specifications

1) Determination of the Cross Section of Rivers and Bridge Length

In principle, a slope ratio of 1:1.5 is adopted for river embankment, and river cross sections are obtained by taking the slope ratio and field survey into account.

2) Determination of the Bridge Width

The following table lists the four classes of rural roads for bridge widths.

Class	Pavement	Pavement Width	Sidewalk	Total Road Width
1	Concrete, Asphalt	not less than 6m	not less than 2m on each side	
2	Concrete, Asphalt, Laterite, Others	not less than 5m	not less than 1.5m on each side	
3	"	not less than 3.5m		not less than 6m
4	"	not less than 3.5m		not less than 5m

Some rural roads have the following standard bridge cross sections.

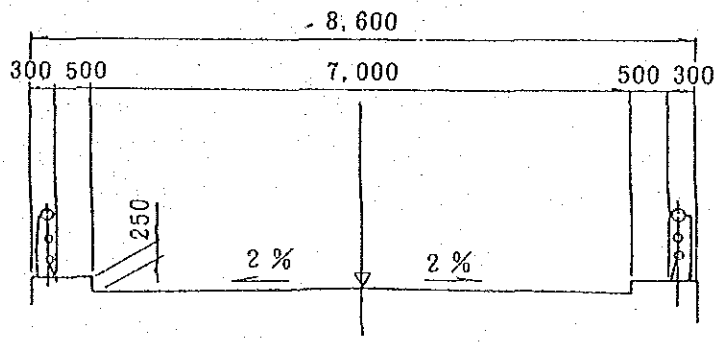
Roadway Width	4.0m	(Class 3.4)
	7.0m	(Class 1, 2)
	8.0m	(Class 1, 2, 3, Local)

From the above, the following two widths for Group I bridges are selected:

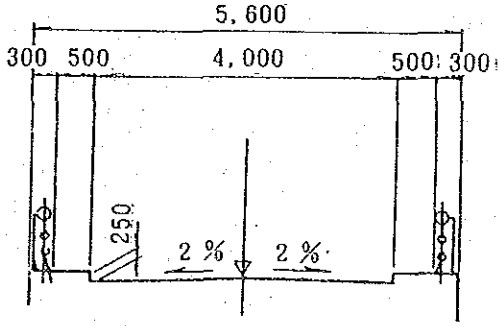
2 lanes	7.0m
1 lane	4.0m

The sidewalk width is determined to be 0.5m, which is the smallest of the standards.

2-lane



1-lane



3) Determination of the Bridge Elevation

Bridge elevation is determined by setting the bottom of girders 1m above HWL to comply with PWD standards. Vertical curves shall be set in approaching roads. Bridge girders shall be level after construction.

The profile of approaching roads is as follows:

Curve length: more than 30m or bridge length/2

Grade : less than 5%

4) **Alignment of the Center Line**

Since bridges in Group I is generally not long, no modification is added to alignment, except for bridges in 05.05 with sharp curves in both approaching roads.

5.2 Site Survey

5.2.1 General

Topographical and geological surveys must be conducted by PWD (Rural Road Division). The survey of the Japanese side was conducted to determine or confirm the following items.

- bridge length
- need for detour during construction period
- traffic volume
- possibility of transporting girders

5.2.2 Hydrologic Conditions

Many tributaries of the Mekong River are located in the northeast region forming a border between Thailand and Laos. Many small rivers connect these tributaries to lakes. A flat topography or "Khorat plateau" causes the river to flow very slowly and flood during the rainy season. The main rivers are the Mum, which meets Mekong River 80 km east of Ubon Ratchatani, and two branches of Chi River. Consequently, the area subject to the above-mentioned flooding forms a basin for Mum River and Chi River, which are very winding rivers.

The annual rainfall in this area reaches an average of 1,100 mm (940 mm in Nakhom Ratchasima and 2,177 mm at Nakhon Phanom facing Mekong River). 90 percent of the annual rainfall is recorded during the rainy season (May to Oct.).

To design the bridges (especially determining the bridge length), the water level and river width in case of flooding at the site must be considered. It is realistic to survey HWL and the river width during past flooding, and to use such survey results in the design because hydrological analysis is impressible.

5.3 Determination of the Bridge Type

5.3.1 Determination of the Superstructure

Bridges in Group I will use the steel materials supplied from Japan's under Grant Aid and will be constructed using the H-shape steel due to technical ease and reduced cost. Consequently the maximum span length is 20m. The number of spans is 2 at most.

5.3.2 Determination of the Substructure

In principle, the followings have been in accordance with PWD standards.

Abutment	---	Pile bent type or inverted T type.
Pier	---	Pile bent type for height less than 7m above river bed. Wall type or column type for height of more than 7 m and for spread foundation.

Foundation pile --- RC Pile □ 350 x 350,
□ 400 x 400

Table 5.3-1 shows the lengths, widths and spans of all bridges.

Table 5.3-1

Unit: m

No.	Bridge No.	Name of Bridge	Existing Br. Length	Proposed Br. Length	Final		Span
					Br. Length	Width	
1	02 02	Huai Nong Ben	20	25	25.89	7.0	12.5 x 2
2	02 03	Huai Tnag	20	25	29.89	7.0	14.5 x 2
3	03 01	Huai Khon Tha	16	20	20.46	7.0	20.0
4	03 02	Huai Yai	22	25	29.89	7.0	14.5 x 2
5	03 03	Huai Phai No. 1	14.5	18	20.46	7.0	20.0
6	03 04	Huai Huai No. 2	10	15	19.46	7.0	19.0
7	04 04	Huai Na Khoi	12	20	20.46	7.0	20.0
8	04 05	Huai Na Krathum	10	20	20.46	7.0	20.0
9	05 04	Lam Ta Khong No. 1	12	15	19.46	4.0	19.0
10	05 05	Lam Ta Khong No. 2		20	30.89	4.0	15.0 x 2
11	06 01	Huai Sieo	27	30	33.89	7.0	16.5 x 2
12	06 03	Huai Lom Khom No. 2	10	15	19.46	7.0	19.0
13	06 04	Huai Na	10	15	16.46	7.0	16.0
14	07 07	Huai Po	14.5	20	20.46	7.0	20.0
15	07 08	Huai Ngui	22	30	30.89	7.0	15.0 x 2
16	08 01	Huai Wang Pla Sium	21	25	25.89	7.0	12.5 x 2
17	08 02	Huai Na Pong	15.5	20	20.46	7.0	20.0
18	08 03	Huai Khaen	15.2	20	20.46	7.0	20.0
19	08 04	Huai Khaen Long No. 1	17.5	20	20.46	7.0	20.0
20	08 05	Huai Khaen Long No. 2	17	20	23.89	7.0	11.5 x 2
21	09 01	Huai Pla Pong	20	25	25.89	7.0	12.5 x 2
22	09 03	Huai Siao No. 1	32	40	34.89	7.0	17.0 x 2
23	90 04	Huai Siao No. 2	24	40	25.89	7.0	12.5 x 2
24	10 01	Huai Palan Nuang	22	25	25.89	7.0	12.5 x 2
25	10 02	Huai Kantruat	20	25	20.46	7.0	20.0
26	11 03	Ben Na Kae	30	30	30.89	7.0	15.0 x 2
27	12 02	Huai Thamo	18	20	20.46	7.0	20.0
28	13 01	Huai Sieo No. 1	16	20	24.89	7.0	12.0 x 2
29	13 02	Huai Sieo No. 2	9	15	19.46	7.0	19.0
30	13 03	Huai Ban Mui	12	30	30.89	7.0	15.0 x 2
31	13 04	Huai Ran	15	20	22.89	7.0	11.0 x 2
32	13 05	Huai Bang Phuan No. 1	12	20	20.46	4.0	20.0
33	13 06	Huai Bang Phuan No. 2	16	20	20.46	4.0	20.0
34	14 04	Nong Bung Mo No. 1	8	15	18.46	7.0	18.0
35	14 05	Nong Bung Mo No. 2	12	15	18.46	7.0	18.0
36	14 06	Nong Bung Mo No. 3	23	25	25.89	7.0	14.5 x 2
37	14 07	Nong Bung Mo No. 4	---	18	20.46	7.0	20.0
38	15 03	Huai Sa Do	25	30	30.89	7.0	15.0 x 2
39	15 04	Huai So Phra	21	25	27.89	7.0	13.5 x 2
40	15 05	Huai Shoek	25	30	30.89	7.0	15.0 x 2
41	15 06	Huai Khaen	24	25	32.89	7.0	16.0 x 2

5.4 Superstructure Design

5.4.1 Design Criteria

· Design Specifications:	AASHTO Standard Specifications (13th Edition, 1983)
· Live Load:	HS20-44 (MS18) Sidewalk --- 300 kg/m^2
· Temperature Range:	15°C
· Slab Concrete:	fc' = 210 kg/cm^2, w = 2.4 t/m^3
· Pavement:	Concrete 2.4 t/m^3
· Maximum Member Length:	15.5 m (Max. Steel Material Length --- Limited by inland transport in Thailand)
· Steel Materials:	JIS SMA41W, Fy = 2,400 kg/cm^2 Fa = 1,400 kg/cm^2
	SMA50W, Fy = 3,600 kg/cm^2 Fa = 2,100 kg/cm^2
· Railing:	Steel (Melted Zinc Galvanizing)

5.4.2 Superstructure

Figure 5.4-1 shows typical general views of H-shape steel bridges and their standard cross-sections that conform to the design standards of Japan's Ministry of Construction.

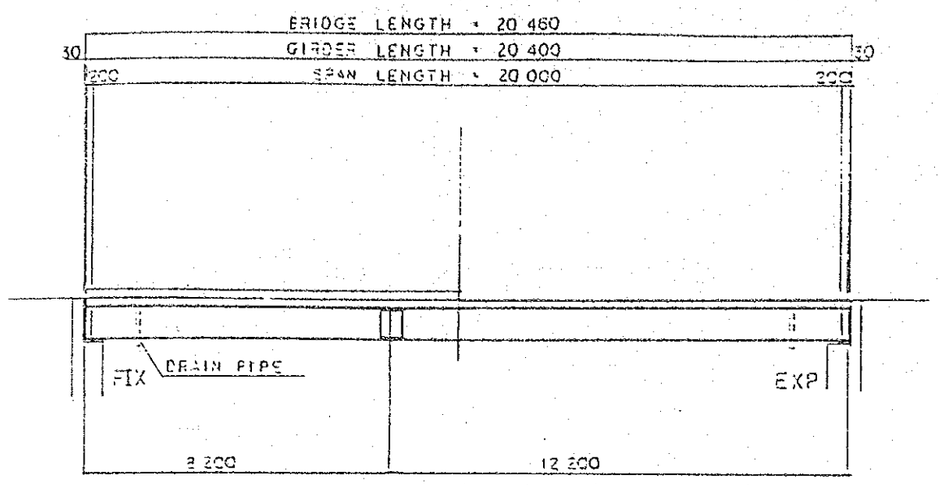
Table 5.4-1 lists the calculation results of all bridges. Tables 5.4-2 and -3 list the reactions of superstructures.

5.4.3 Weathering Steel

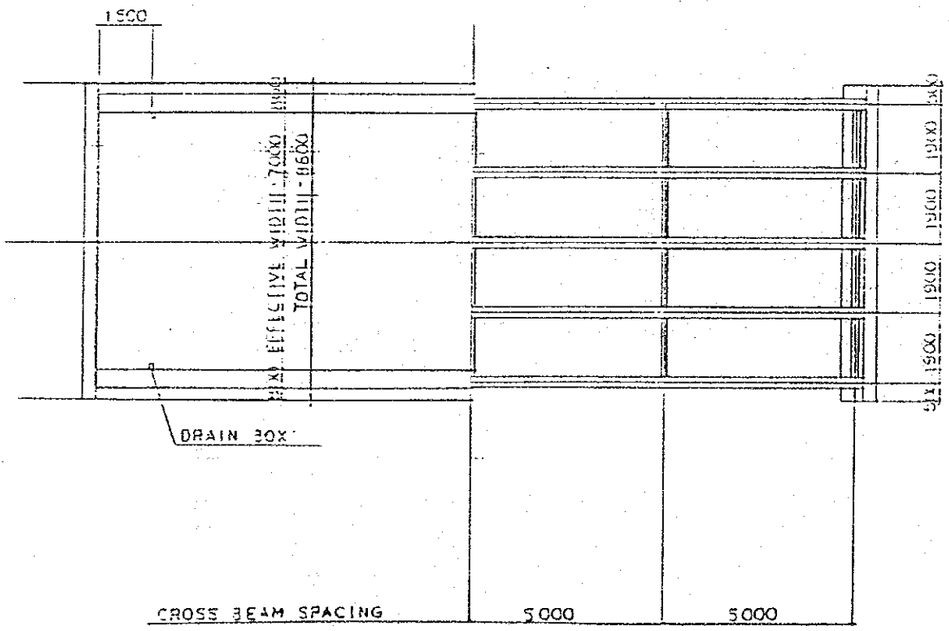
Weathering Steel will be used for the superstructures, taking into consideration a reduction of maintenance costs for the Thai government.

In the application of this steel, attention must be paid to the following structural details.

1. Expansions must be so designed that the rain water does not drop down through them.
2. Drainage pipes must reach down to such a position that the water does not splash to the steel of girders.
3. The drainage around shoes must be provided.
4. Corners of the steel members must be so designed that water does not remain.

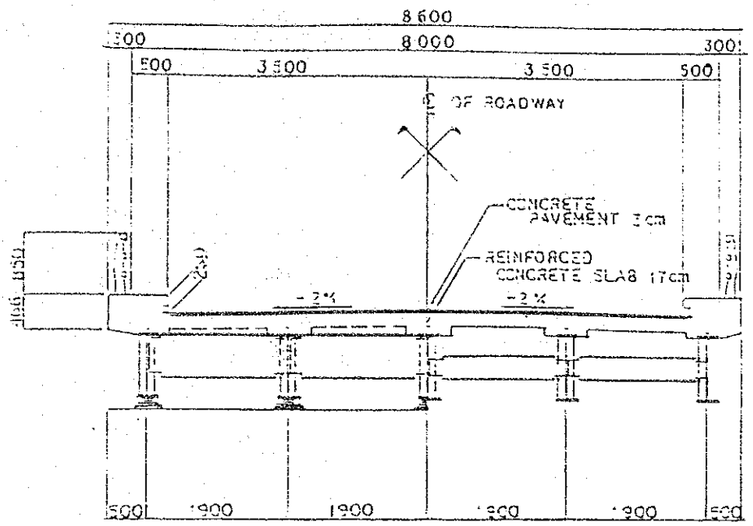


GENERAL ELEVATION

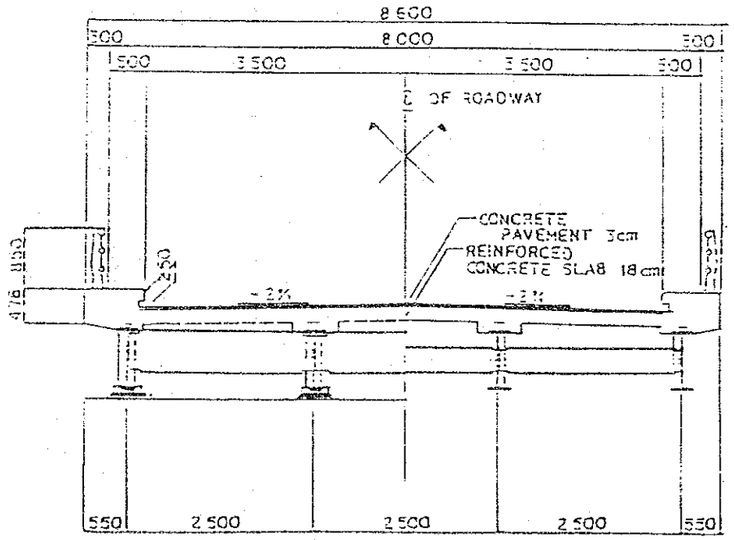


GENERAL PLAN

FIGURE 5.4-1-A GENERAL VIEW (GROUP I)

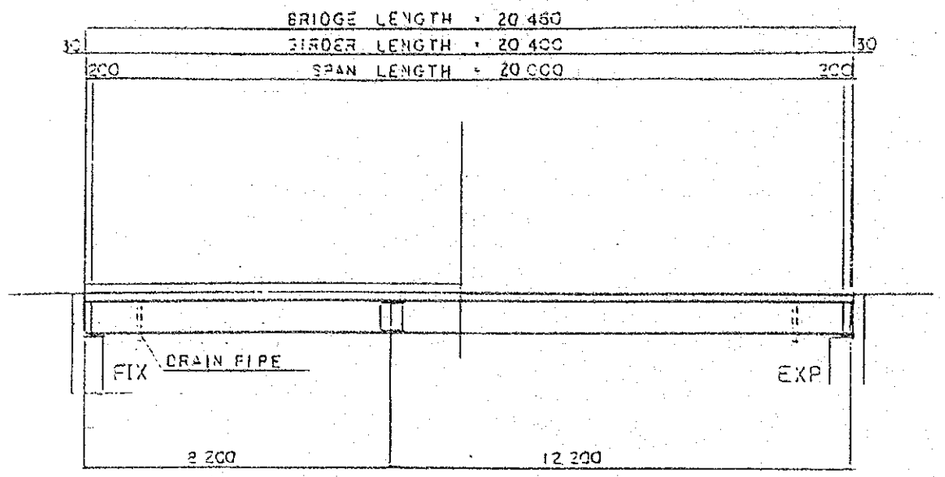


H－BEAM BRIDGE (SPAN 18-20m)

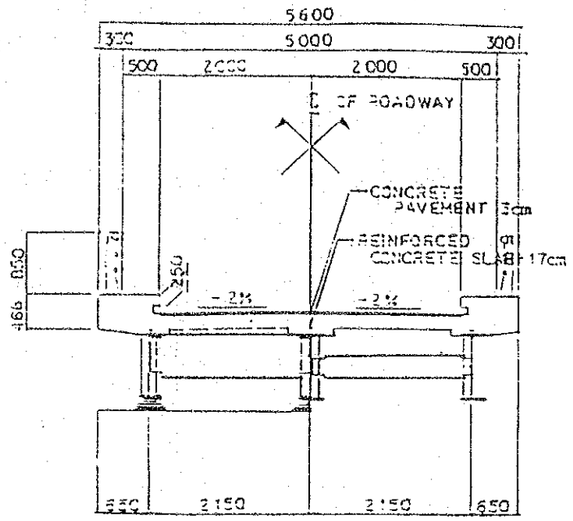


H－BEAM BRIDGE (SPAN 11-17m)

SUPERSTRUCTURE CROSS SECTION

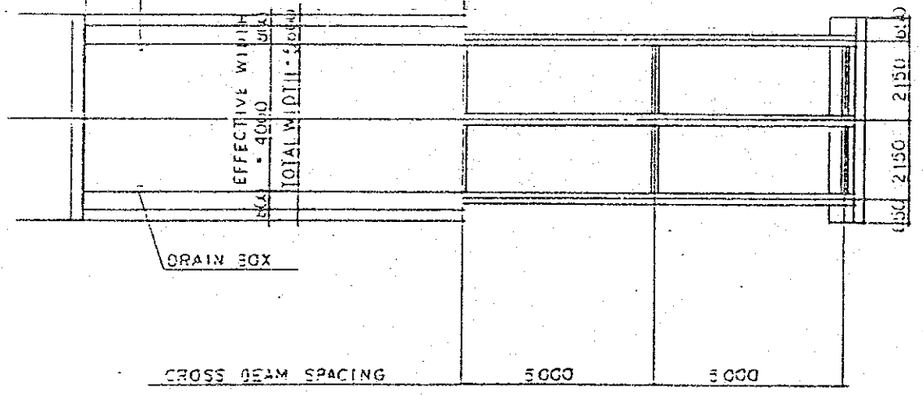


GENERAL ELEVATION



H－BEAM BRIDGE (SPAN 15, 19, 20m)

SUPERSTRUCTURE CROSS SECTION



GENERAL PLAN

FIGURE 5.4-1-B GENERAL VIEW (GROUP I)

TABLE 5.4-1 Main Girder Section and Stress (G r u o p [ )

Span (m)		11	11.5	12	12.5	13.5	14.5	15	15	16	16.5	17	18	19	19	20	20
Roadway Width (m)		7	7	7	7	7	7	4	7	7	7	7	7	4	7	4	7
Main Girder Size		H700×300	H700×300	H700×300	H700×300	H792×300	H800×300	H792×300	H890×300	H900×300	H900×300	H900×300	H900×300	H900×300	H912×362	H912×302	H912×302
Steel Grade		SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50
Sectional Properties	Moment of Inertia (cm^4)	201000	201000	201000	201000	254000	292000	254000	345000	411000	411000	411000	411000	411000	498000	498000	498000
	Area of Cross Section (cm^2)	235.5	235.5	235.5	235.5	243.4	267.4	243.4	270.9	309.8	309.8	309.8	309.8	309.8	364.0	364.0	364.0
	Section Modulus (cm^3)	5760	5760	5760	5760	6410	7290	6410	7760	9140	9140	9140	9140	9140	10900	10900	10900
	Plastic Section Modulus (cm^3)	6460	6460	6460	6460	7290	8240	7290	8910	10450	10450	10450	10450	10450	12500	12500	12500
Bending Moment	Service Load (t·m)	81.1	87.9	94.8	101.8	116.1	130.9	109.0	138.5	154.0	162.0	170.0	145.8	162.1	159.2	176.5	172.9
	Maximum Design Load (t·m)	148.5	160.6	172.9	185.3	210.5	236.3	188.7	249.4	276.0	289.5	303.2	256.9	275.1	279.0	298.1	301.7
Bending Stress	Stress (kg/cm^2)	1408	1526	1645	1767	1811	1796	1700	1785	1685	1772	1860	1596	1773	1461	1619	1587
	Allowable Stress (kg/cm^2)	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
	Maximum Bending Strength (t·m)	232.6	232.6	232.6	232.6	262.4	296.6	262.4	320.8	376.2	376.2	376.2	376.2	376.2	450.0	450.0	450.0
Shear	Service Load (t)	34.9	35.8	36.6	37.3	38.8	40.2	31.7	40.9	42.2	42.8	43.4	34.9	36.2	35.8	37.3	36.8
	Maximum Design Load (t)	65.8	67.2	68.4	69.6	71.9	74.0	56.1	75.0	77.0	77.9	78.8	62.4	62.4	63.8	63.9	65.1
Shear Stress	Stress (kg/cm^2)	412	422	431	440	370	384	303	323	312	317	322	258	268	236	245	242
	Allowable Stress -(kg/cm^2)	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	Maximum Shear Force (t)	167.8	167.8	167.8	167.8	207.3	207.3	207.3	250.7	267.4	267.4	267.4	267.4	267.4	300.8	300.8	300.8
Deflection	Deflection	1/1209	1/1064	1/945	1/845	1/873	1/837	1/964	1/909	1/926	1/861	1/803	1/878	1/889	1/940	1/957	1/838
	Allowable Deflection	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800	1/800

Table 5.4-2 Superstructure Reaction for One Abutment (Group I)

Span (m)	Roadway Width (m)	Vertical Reaction (t)			Wind (t) (Horizontal)
		Dead Load	Live Road	Total	
11	7	41.1	49.7	90.8	1.39
11.5	7	43.0	50.5	93.5	1.45
12	7	44.8	51.3	96.1	1.52
12.5	7	46.7	51.9	98.6	1.58
13.5	7	50.5	53.1	103.6	1.80
14.5	7	54.2	54.2	108.4	1.94
15	4	39.4	28.5	67.9	1.99
15	7	56.1	54.7	110.8	2.11
16	7	59.8	55.7	115.5	2.26
16.5	7	61.7	56.1	117.8	2.33
17	7	63.5	56.5	120.0	2.41
18	7	70.5	57.3	127.8	2.53
19	4	50.0	30.8	80.8	2.67
19	7	74.5	57.9	132.4	2.69
20	4	52.6	30.8	83.4	2.83
20	7	78.4	58.6	137.0	2.83

Table 5.4-3 Superstructure Reaction for One Pier (Group I)

Span (m)	Roadway Width (m)	Vertical Reaction (t)			Wind (t) (Horizontal)
		Dead Load	Live Load	Total	Lateral
11	7	82.2	51.3	133.5	2.78
11.5	7	86.0	52.2	138.2	2.90
12	7	89.7	53.2	142.7	3.04
12.5	7	93.4	53.8	147.2	3.16
13.5	7	100.9	55.2	156.1	3.60
14.5	7	108.4	56.4	164.8	3.88
15	4	78.9	30.7	109.6	3.98
15	7	112.1	57.0	169.1	4.22
16	7	119.6	58.1	177.7	4.52
16.5	7	123.3	59.2	182.5	4.66
17	7	127.1	60.2	187.3	4.82

5.5 Substructure Design

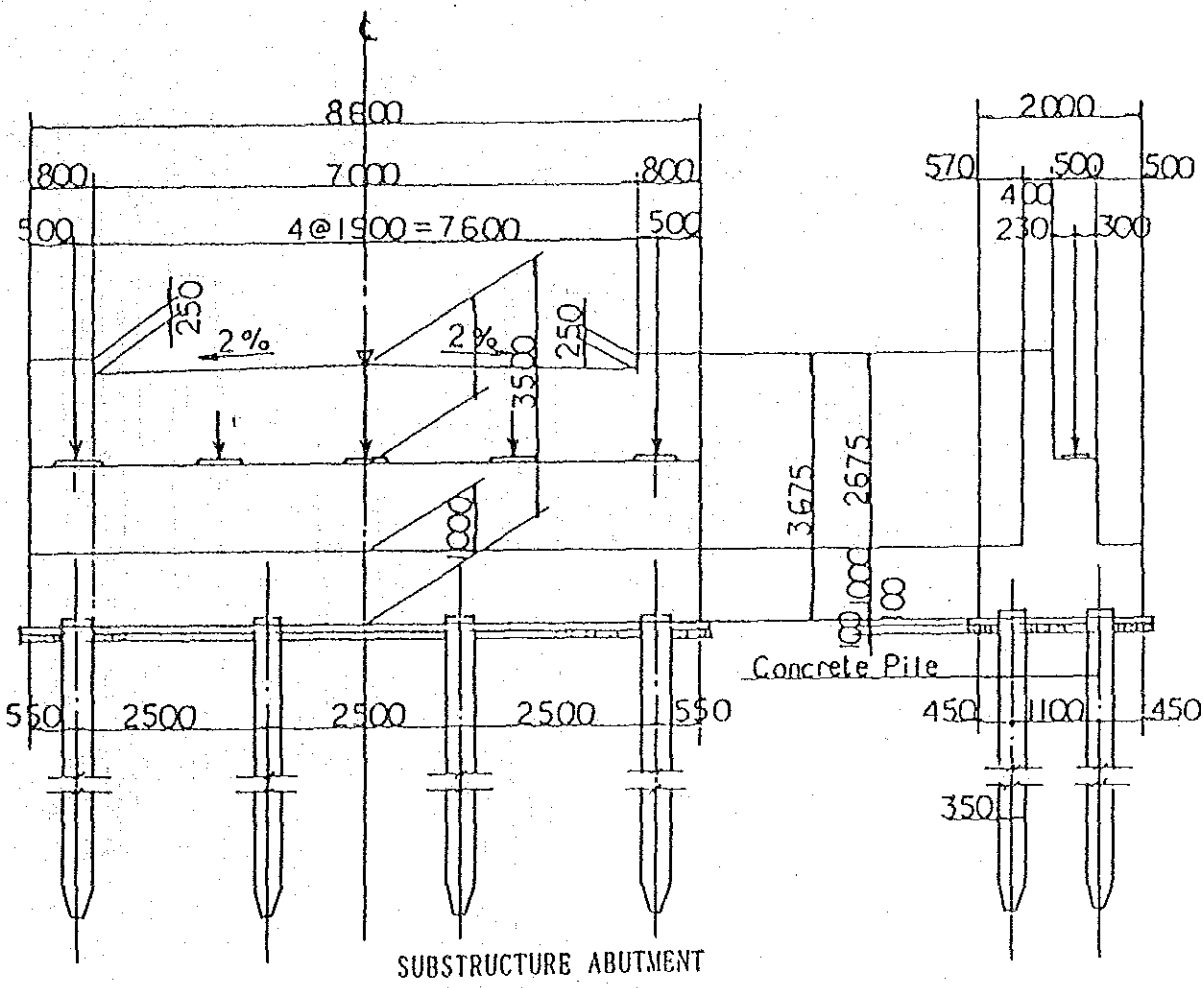
5.5.1 Design Criteria

Design Specifications:	AASHTO Standard Specifications (13th Edition, 1983)
Wind Load:	150 kg/m^2
Concrete:	fc' = 210 kg/m^2 (fca = 70 kg/cm^2)
Reinforcement Steel:	fy = 2,400 kg/cm^2
	(fa = 1,200 kg/cm^2 for Plain Bar)
	(fa = 1,400 kg/cm^2 for Deformed Bar)
Backfill Soil:	δ = 1.8 t/m^3, ϕ = 30°
	Surcharge 1t/m^2

5.5.2 Substructure

Figure 5.5-1 shows standard abutments and piers of bridges of Group I.

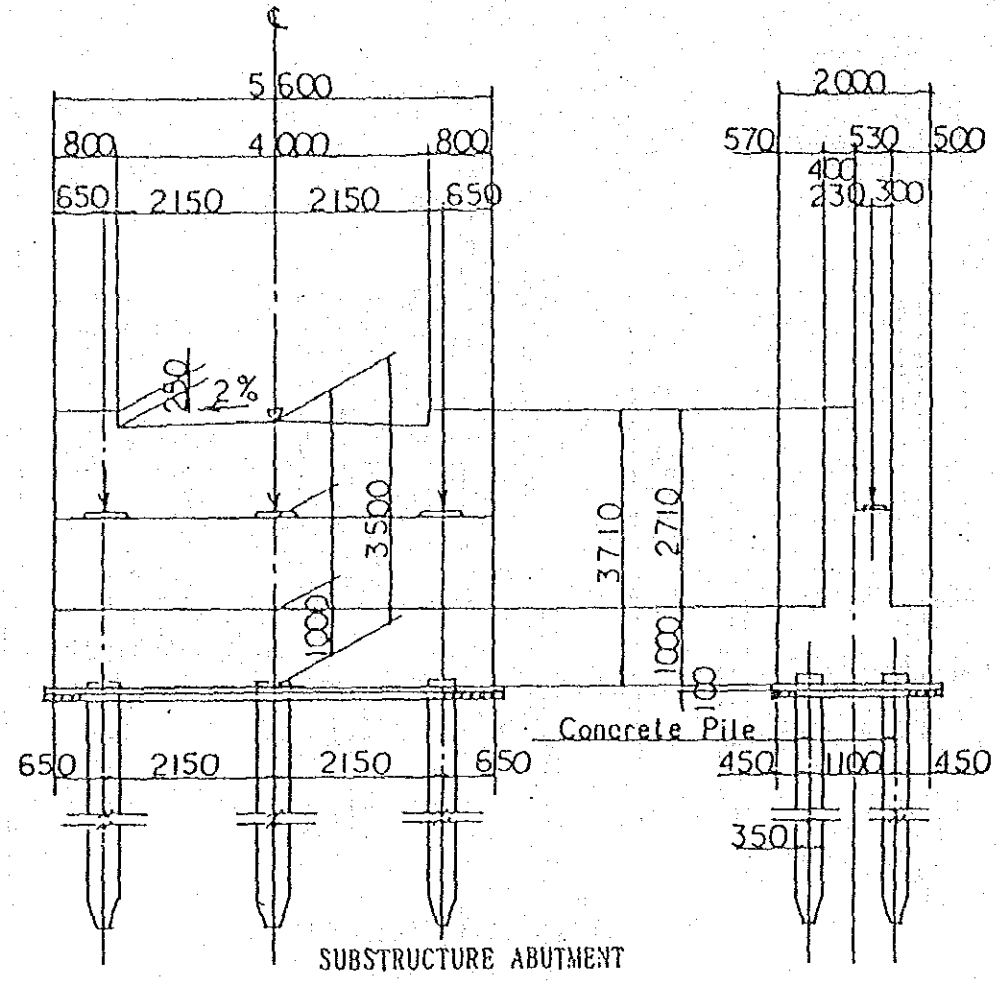
Table 5.5-1 lists the figures of substructures.



SUBSTRUCTURE ABUTMENT

SCALE 1:100

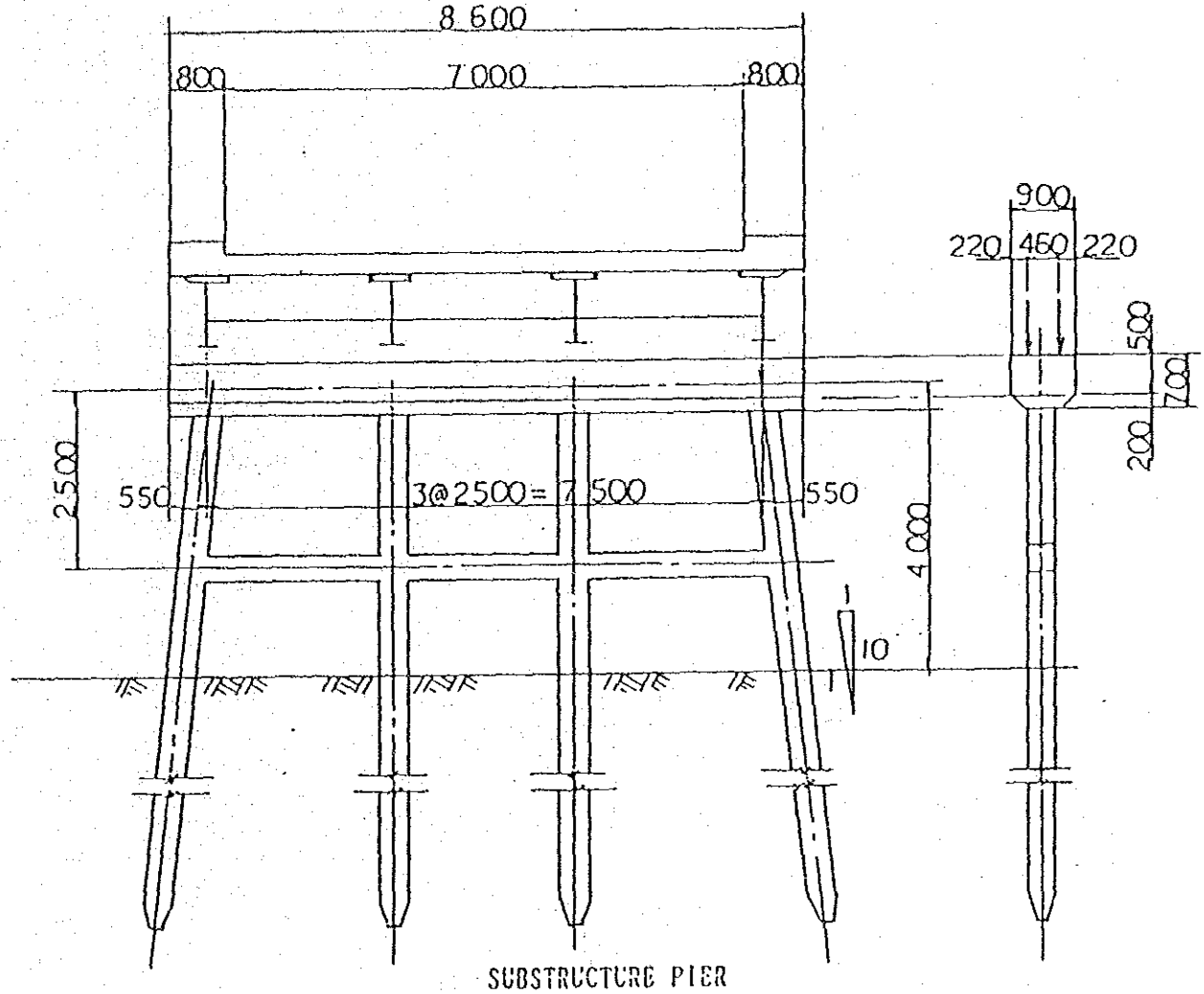
Fig. 5.5-1 A



SUBSTRUCTURE ABUTMENT

SCALE 1:100

Fig. 5.5-1 B



SUBSTRUCTURE PIER

SCALE 1:100

Fig. 5.5-1 C

Table 5.5-1 Figures of Piles

Br. No.	Span	Height h(m)	Width (m)	Reaction from Superstructure (t) Rd	Rl	Total	Pile Size	Number
02.02	12.5[m] x 2	3.0	7.0	93.4	53.8	147.2	350[mm] x350[mm]	4
02.03	14.5 x 2	5.5	7.0	108.4	56.5	164.8	400 x400	4
03.02	14.5 x 2	3.0	7.0	108.4	56.5	164.8	400 x400	4
05.05	15.0 x 2	3.0	4.0	78.9	30.8	109.6	350 x350	3
06.01	16.5 x 2	5.0	7.0	123.3	58.6	182.5	400 x400	4
08.01	12.5 x 2	5.0	7.0	93.4	53.8	147.2	350 x350	4
09.01	12.5 x 2	4.0	7.0	93.4	53.8	147.2	350 x350	4
09.03	17.0 x 2	4.0	7.0	127.1	59.0	187.3	400 x400	4
09.04	12.5 x 2	4.0	7.0	93.4	53.8	147.2	350 x350	4
10.01	12.5 x 2	4.0	7.0	93.4	53.8	147.2	350 x350	4
11.03	15.0 x 2	2.7	7.0	112.1	57.0	169.1	400 x400	4
13.01	12.0 x 2	2.5	7.0	89.7	53.0	142.7	350 x350	4
13.03	15.0 x 2	3.0	7.0	112.1	57.0	169.1	400 x400	4
13.04	11.0 x 2	3.0	7.0	82.2	51.3	133.5	350 x350	4
14.06	12.5 x 2	3.0	7.0	93.4	53.8	147.2	350 x350	4
15.03	15.0 x 2	4.0	7.0	112.1	57.0	169.1	Wall Type	Spread
15.04	13.5 x 2	7.0	7.0	100.9	55.2	156.1	Wall Type	8
15.05	15.0 x 2	3.5	7.0	112.1	57.0	169.1	400 x400	4
15.06	16.0 x 2	4.0	7.0	119.6	58.1	177.7	400 x400	4

assumed allowable bearing capacity

350 x 350 Ra=45t/pile

400 x 400 Ra=55t/pile

CHAPTER 6 BASIC DESIGN

GROUP II

CHAPTER 6 BASIC DESIGN (Group II)

6.1 Basic Principles

(1) Basic Conditions for the Project

Refer to 5.1 (1)

(2) Superstructure

Refer to 5.1 (2)

(3) Substructure

According to the policy of conforming to the structural standards used in Thailand, the following were selected.

- Abutment: The seat type is adopted.
- Pier: The standard pile bent type is adopted in cases where the height is less than 7 m. In cases exceeding 7 m, a shallow support layer or spread foundation is adopted.
- Foundation Pile: Standard Pile, RC 400 x 400

(4) Bridge Specifications

1) Determination of the Cross Section of River and Bridge Length

Refer to 5.1 (4), 1)

2) Determination of the Bridge Width

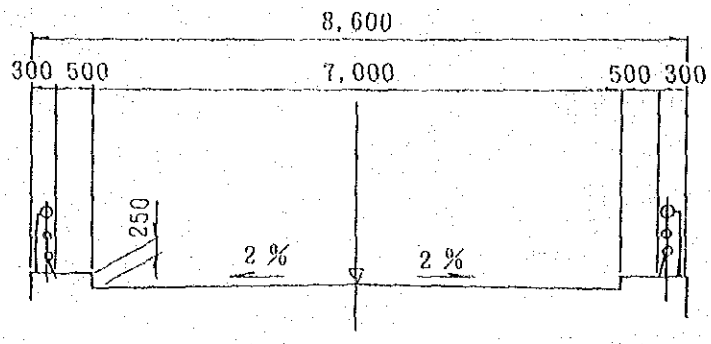
Refer to 5.1 (4), 2)

From the PWD standards, the following two widths are selected:

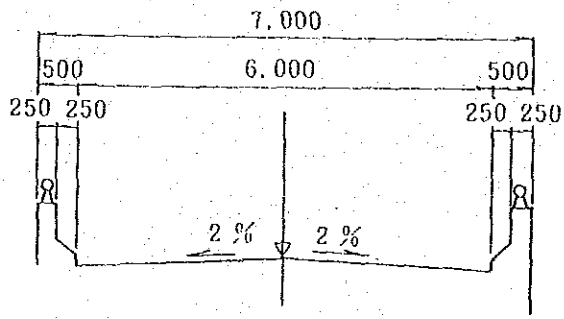
2 lanes	7.0m
2 lanes	6.0m (special case)

The sidewalk width is determined to be 0.5m, which is the smallest of the standards.

2-lane



2-lane



3) Determination of the Bridge Elevation

Refer to 5.1 (4), 3)

4) Alignment of the Center Line

For bridges in Group II, after examining the:

- alignment of Access Roads
- topography at the bridge site,
- appropriateness of access roads and
- difficulty in constructing detours,

the following were determined:

01.01 modified
02.05 "
04.01 not modified
04.02 "
05.01 modified
05.02 "
05.03 "
11.01 "

14.02 no bridge exists.

15.07 not modified

In modifying the center line, the following are assumed:

1 Land will be submitted by the owners; a land fee was not considered in our estimate.

2 Soil materials for embankments can be procured locally.

3 The areas from which soil has been removed for road banking will be available as irrigation ponds for local residents.

4 The selected materials are to be procured locally.

5 Pavement composed of laterite is less expensive.

5) **Determination of the Span Length**

For bridges in Group II, the flow of the following rivers in rainy season exceeds 500 m^3/sec.

14.02 Bridge length 110m

15.07 " 50m

According to Japanese regulations (i.e., Ordinance on River Administration Facilities), minimum span lengths are determined by considering driftwood as follows:

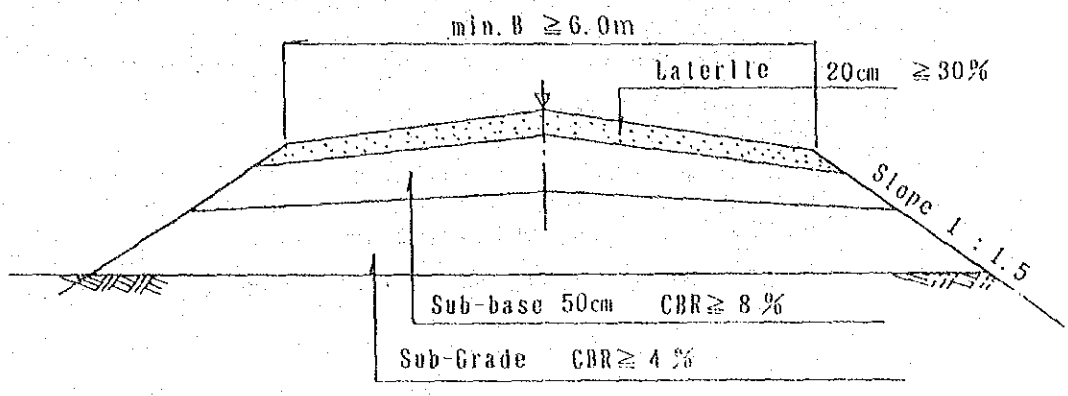
For more than 500 m^2/sec: 20m

For less than 500 m^2/sec: 15m

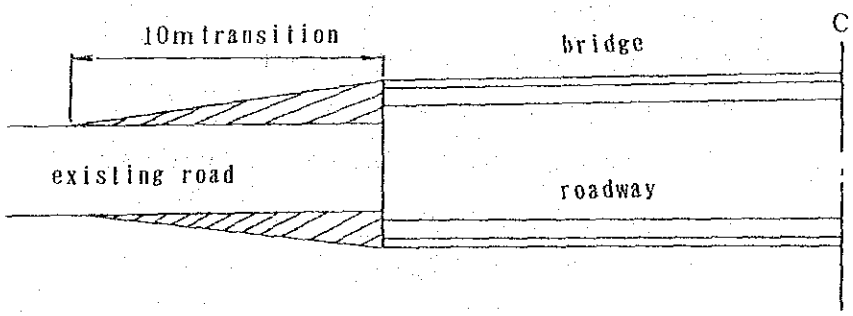
River flooding conditions in the northeast region of Thailand are very different from those in Japan.

However, 20 m at the center spans and 15 m at the side spans are considered necessary.

6) **Cross Section of Approaching Road**



7) **Plan of Approaching Road**



6.2 Site Survey

6.2.1 General

The basic design study mission conducted topographical and geological surveys at the bridge sites. These surveys were to confirm the actual conditions of proposed bridges and to establish the design policy. Ten bridge sites were surveyed by the Japanese side for the following.

- Confirming existing bridge conditions
- Confirming geographical and topographical conditions
- Possibility of constructing detours
- Confirming access roads available for transporting materials and machineries
- Natural conditions during dry and rainy seasons
- HWL in past flooding
- Existence of obstacles
- Other special items

To design the bridge (especially determinating the bridge length), the water level and river width in case of flooding at the site must be determined. After reviewing the natural conditions above, it is realistic to survey HWL and the river width during past flooding, and such survey results must be used in the design because it is difficult to analyze the hydraulics owing to undeveloped river conditions.

6.2.2 Topographical Survey

The topographical survey was conducted to obtain the topographic data necessary for the detailed design of the bridges, access roads and river bank protection, comprising the following works.

(1) Centerline Survey

All bench marks (BM) were established with an assumed elevation, properly monumented with concrete monuments (20 cm x 20 cm x 60 cm). The length of centerline survey was more than 100 m along roads and 50 m along rivers, in front of and behind the bridges.

(2) Profile Survey

The elevation of every 20 meters and at changeable inclination points on the proposed centerline were surveyed.

(3) Cross Section Survey

Along roads : 20 meters intervals, 50 meters in width.
Along rivers: 20 meters intervals, 60 meters in width.
Accuracy : Traversing 1/10,000
Leveling $5\ cm + 3\ cm\sqrt{/S}$
S = level route

(4) Reporting

- Location Maps : 1/50,000
- Topographic Maps : 1/200
- Profile Maps : 1/200, 1/100
- Cross Sections : 1/200
- Field Survey Notes
- Photographs
- BM Point Survey Description

6.2.3 Geological Survey

The geological survey for the design was performed concerning to ten bridges in Group II.

1) Boring

For the ten bridges, borings were worked out at three points for each bridge.

2) Standard penetration test

Standard Penetration tests were conducted at intervals of 1 m for all boring holes.

3) Indoor test

The following indoor tests were conducted according to the AASHTO.

- Moisture content

- Specific gravity
- Liquid and plastic limit
- Grain size
- Unit weight

4) **Results**

- Report
- Sample
- Photos

6.3 Determination of the Bridge Type

6.3.1 Determination of the Superstructure

By considering reduced cost, it has decided to adopt:
H-shape steel: Span length less than 20 m
Plate girders: Span length more than 20 m

6.3.2 Determination of the Substructure

By following PWD standards, substructures have determined:

Abutment	---	Seat type
Pier	---	Pile bent type for height less than 7m above river bed. Column type for heights more than 7 m and for spread foundation.
Foundation pile	---	RC Pile □ 400 x 400

Lengths, widths, spans of all bridges are shown in Table 6.3-2.

TABLE 6.3-2 Lengths, Widths, and Spans of All Bridges

Unit: m

No.	Bridge No.	Name of Bridge	Existing Br.Length	Proposed Br.Length	Final		Span
					Br.Length	Width	
1	02 05	Huai Khum Mum	40	69	47.09	7.0	23 x 2
2	04 01	Huai Soeng No. 1	40	40	40.89	7.0	20 x 2
3	04 02	Huai Soeng No. 2	40	40	40.89	7.0	20 x 2
4	11 01	Lam Nam Kam	70	69	56.42	7.0	15 x 2 25 x 1
5	14 02	Lam Nam Phuai	110	110	112.38	6.0	20 x 4 30 x 1
6	01 01	Huai Kae	45	40	40.89	7.0	20 x 2
7	05 01	Lam Klang	45	49	51.32	7.0	15 x 2 20 x 1
8	05 02	Lam Nam Mum	70	97	81.75	6.0	20 x 4
9	05 03	Lam Phra Phloeng	55	61	61.32	7.0	20 x 3
10	15 07	Lam Som No. a	45	49	51.32	7.0	15 x 2 20 x 1

6.4 Superstructure Design

6.4.1 Design Criteria

· Design Specifications:	AASHTO Standard Specifications (13th Edition, 1983)
· Live Load:	HS20-44 (MS18) Sidewalk --- 300 kg/m^2
· Temperature Range:	15°C
· Slab Concrete:	fc' = 210 kg/cm^2, w = 2.4 t/m^3
· Pavement:	Concrete 2.4 t/m^3
· Maximum Member Length:	15.5 m (Max. Steel Material Length --- Limited by inland transport in Thailand)
· Steel Materials:	JIS SMA41W, Fy = 2,400 kg/cm^2 Fa = 1,400 kg/cm^2
	SMA50W Fy = 3,600 kg/cm^2 Fa = 2,100 kg/cm^2
· Railing:	Steel (Melted Zinc Galvanizing)

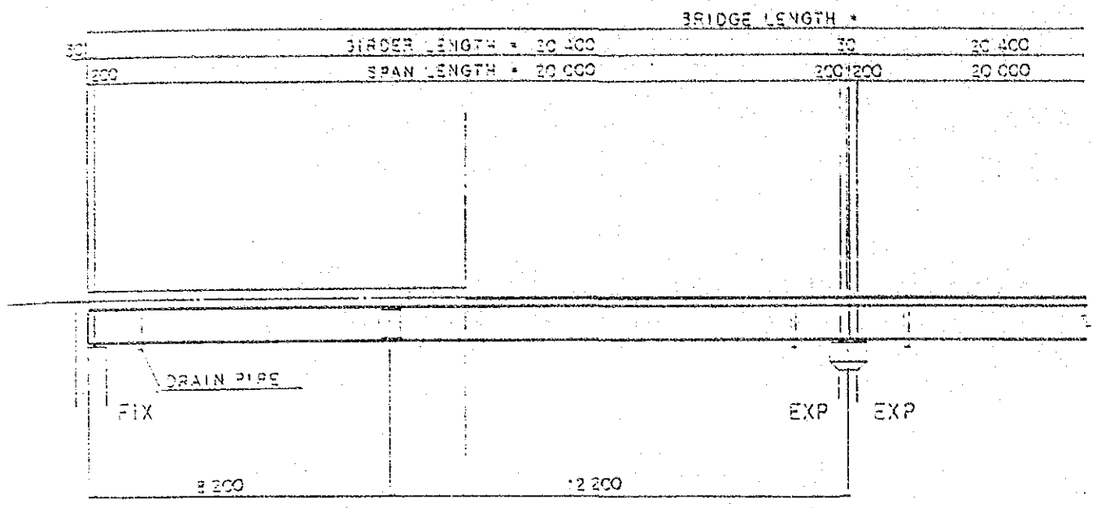
6.4.2 Superstructure

Figures 6.4-1 shows typical general views of Group II bridges and their standard cross-sections that conform to the design standards of the Ministry of Construction of Japan.

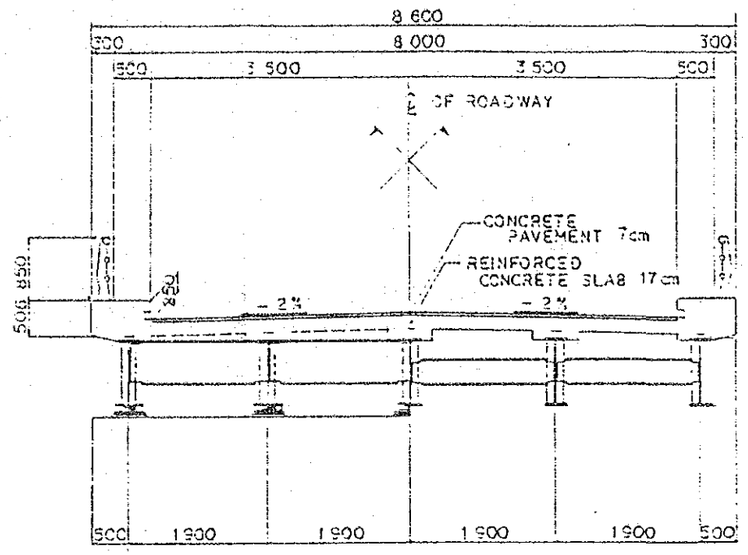
Table 6.4-1 lists the calculation results of all bridges. Tables 6.4-2 and -3 list the reactions of superstructures.

6.4.3 Weathering Steel

Refer to 5.4.3

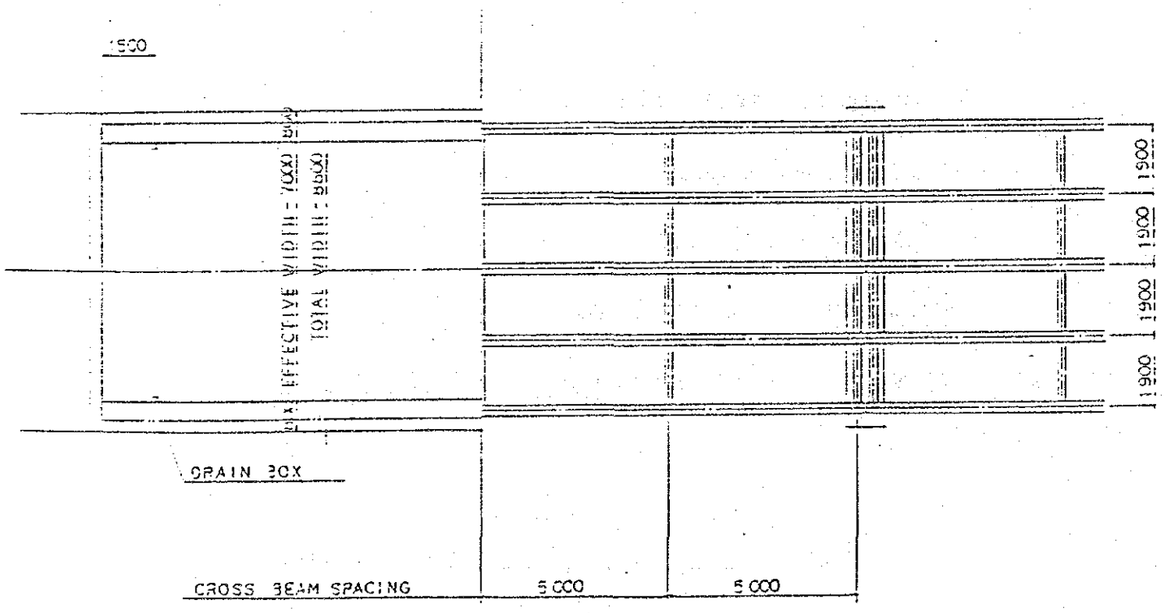


GENERAL ELEVATION



H-BEAM BRIDGE (SPAN 20m)

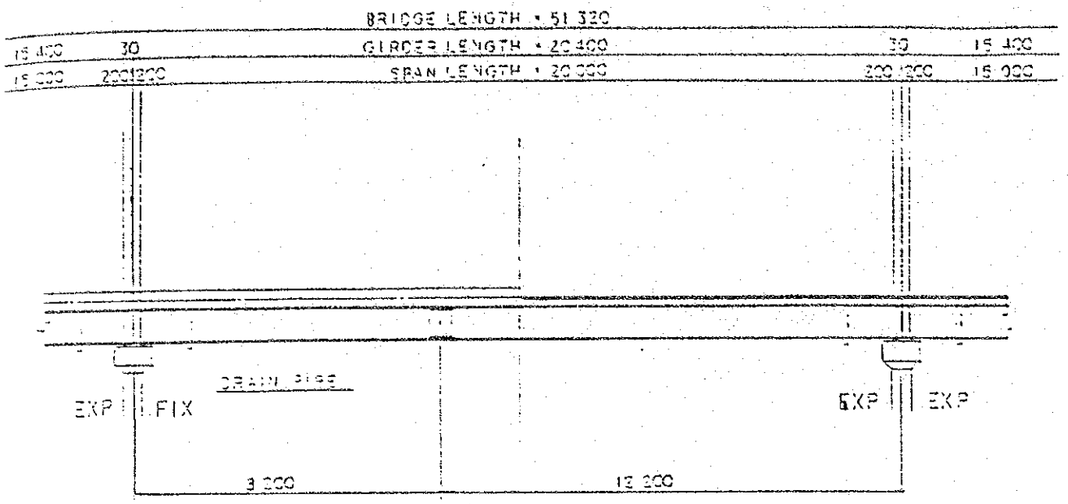
SUPERSTRUCTRE CROSS SECTION



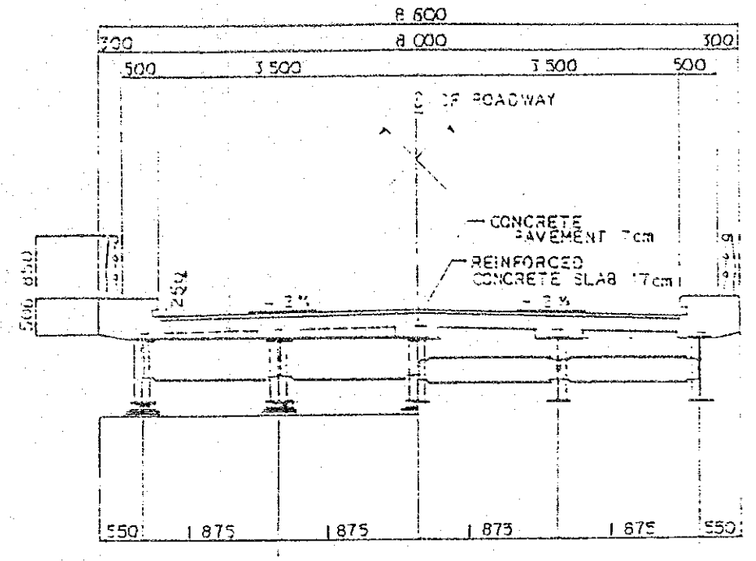
GENERAL PLAN

NO. 01.01 04.01 04.02 05.03

FIGURE 6.4-1A GENERAL VIEW (GROUP II)

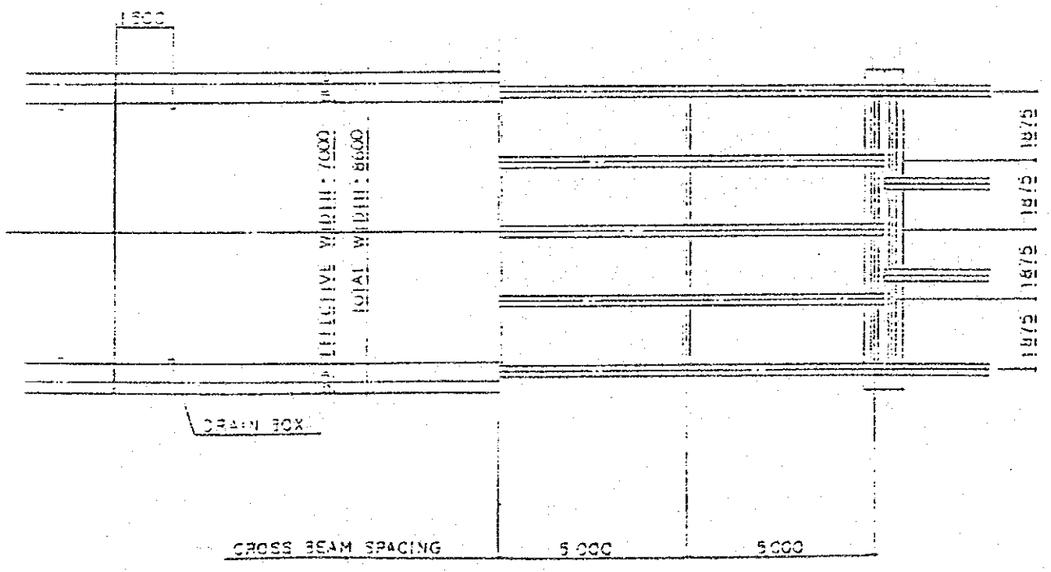


GENERAL ELEVATION



H-BEAM BRIDGE (SPAN 20m)

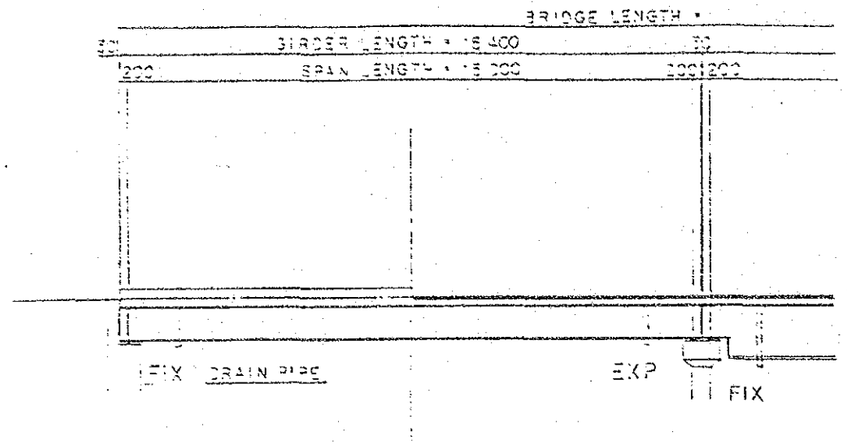
SUPERSTRUCTRE CROSS SECTION



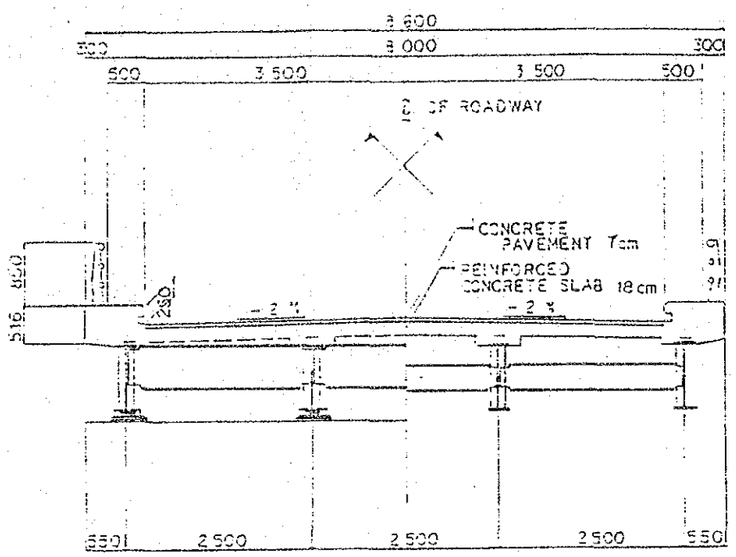
GENERAL PLAN

FIGURE 6.4-1B GENERAL VIEW (GROUP II)

NO. 05.01 15.07



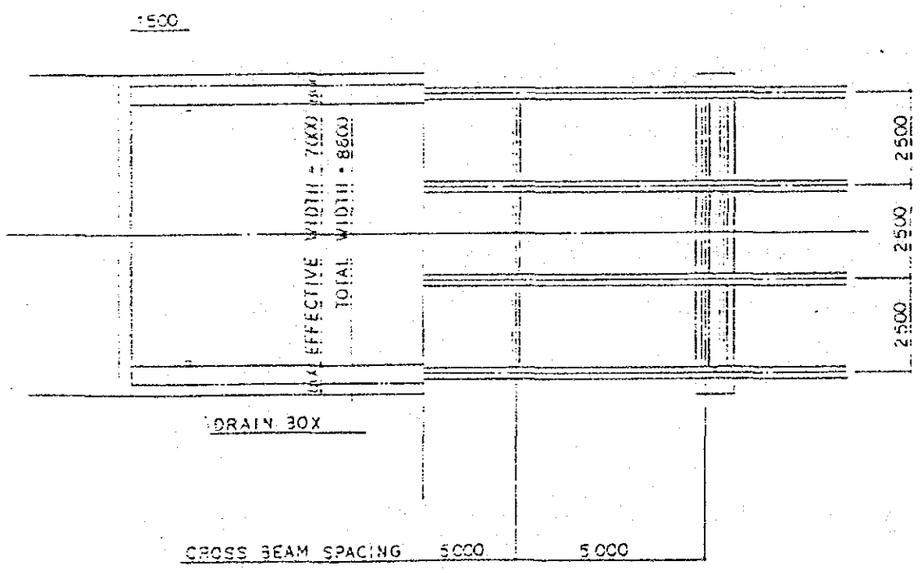
GENERAL ELEVATION



H－BEAM BRIDGE (SPAN15m)

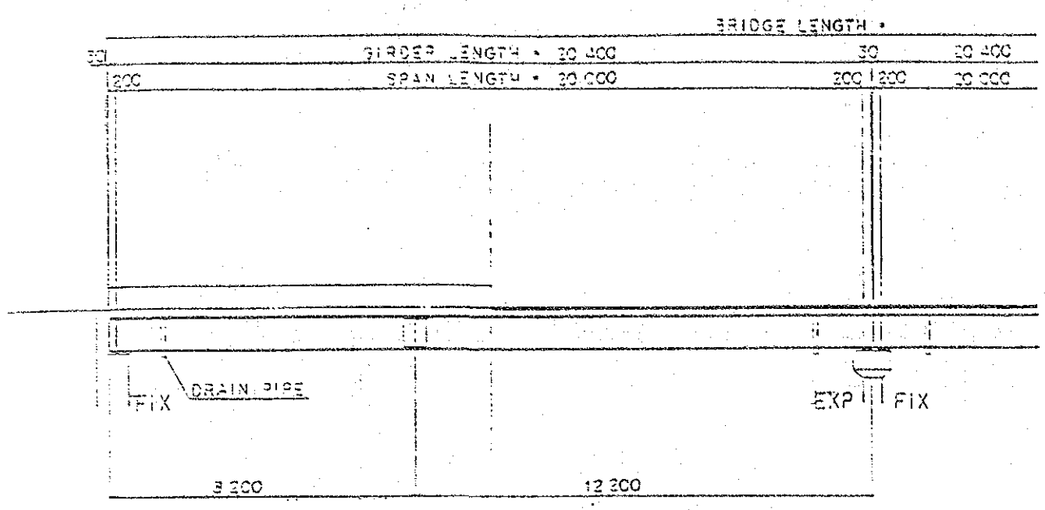
SUPERSTRUCTRE CROSS SECTION

NO. 05.01 11.01 15.07

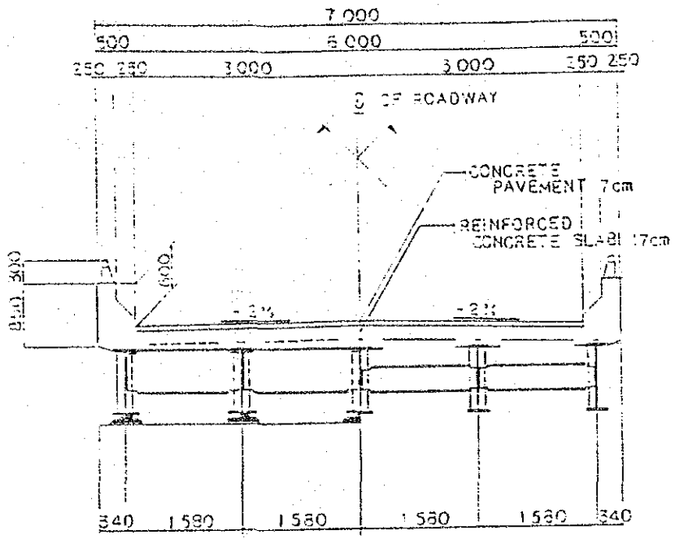


GENERAL PLAN

FIGURE 6.4-1C GENERAL VIEW (GROUP II)



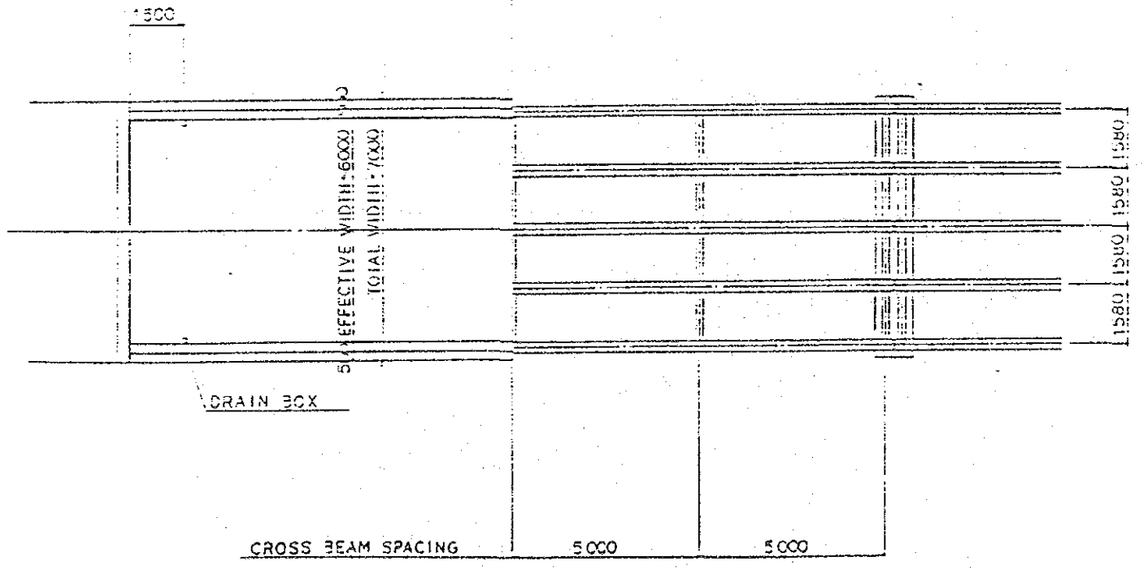
GENERAL ELEVATION



H-BEAM BRIDGE (SPAN 20m)

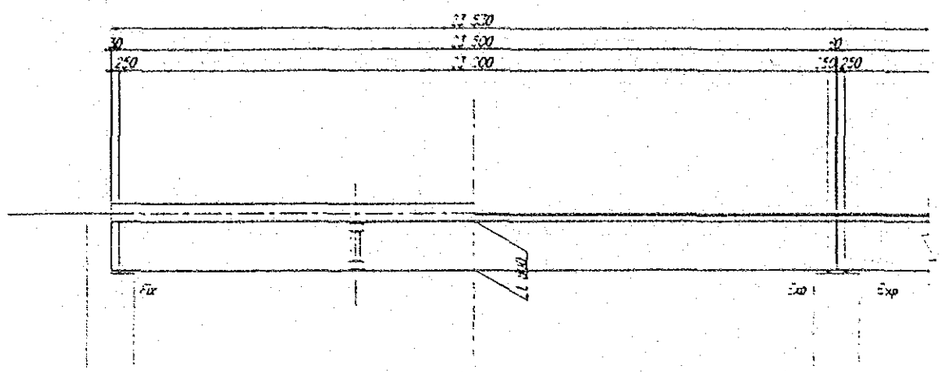
SUPERSTRUCTRE CROSS SECTION

NO. 05.02 14.02



GENERAL PLAN

FIGURE 6.4-1D GENERAL VIEW (GROUP II)



GENERAL ELEVATION

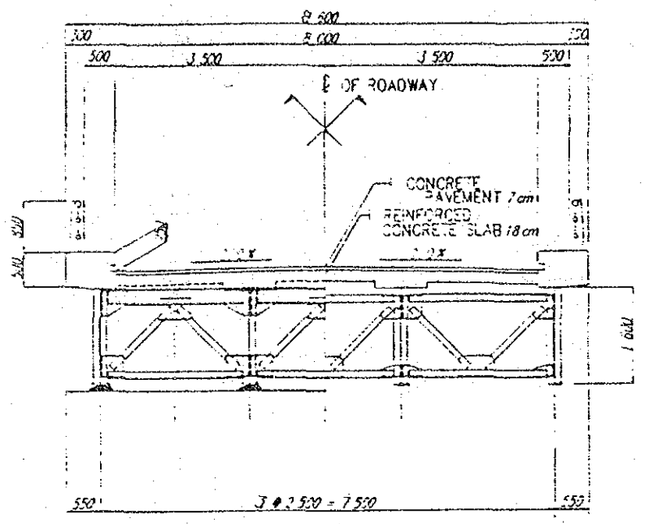
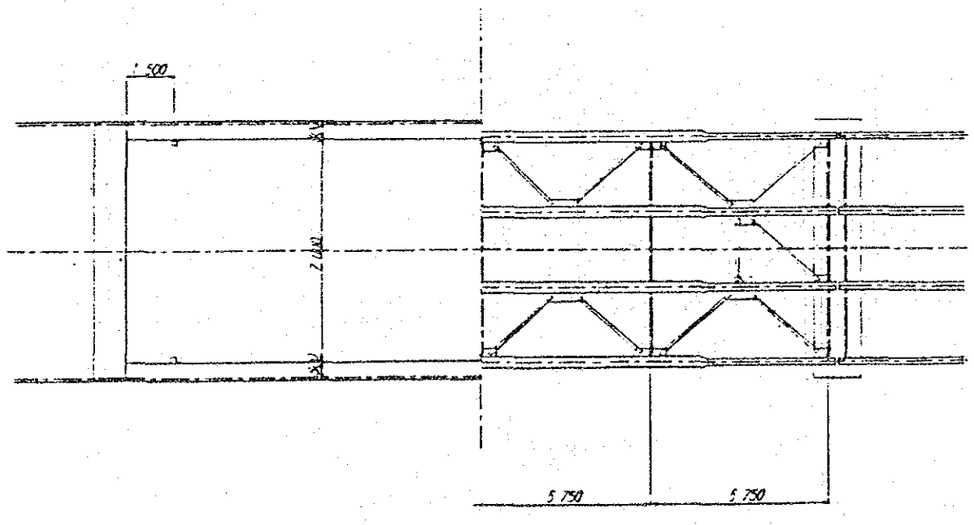


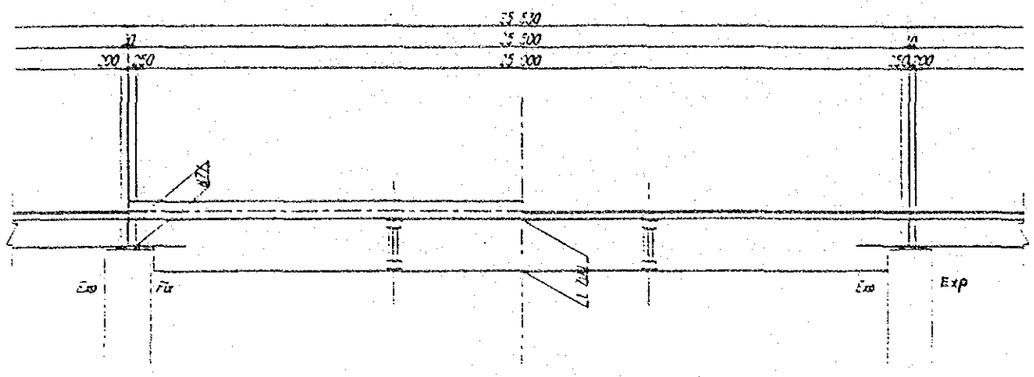
PLATE GIRDER BRIDGE (SPAN 23m)
SUPERSTRUCTRE CROSS SECTION

NO. 02.05

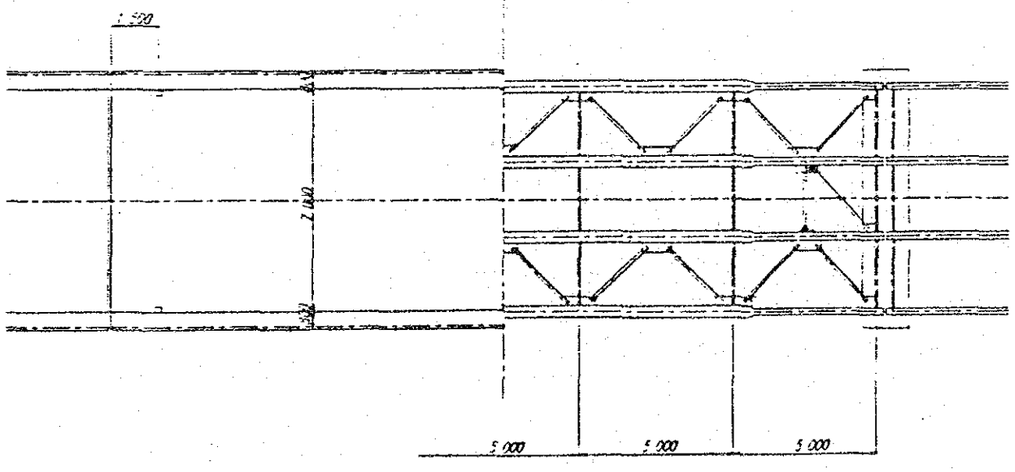


GENERAL PLAN

FIGURE 6.4-1E GENERAL VIEW (GROUP II)



GENERAL ELEVATION



GENERAL PLAN

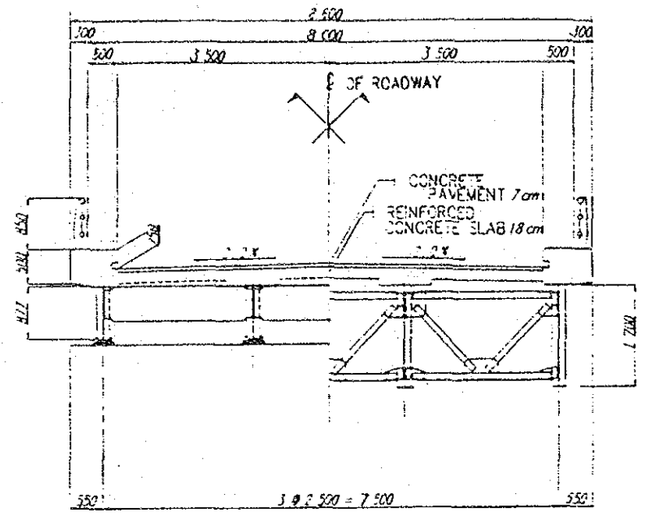
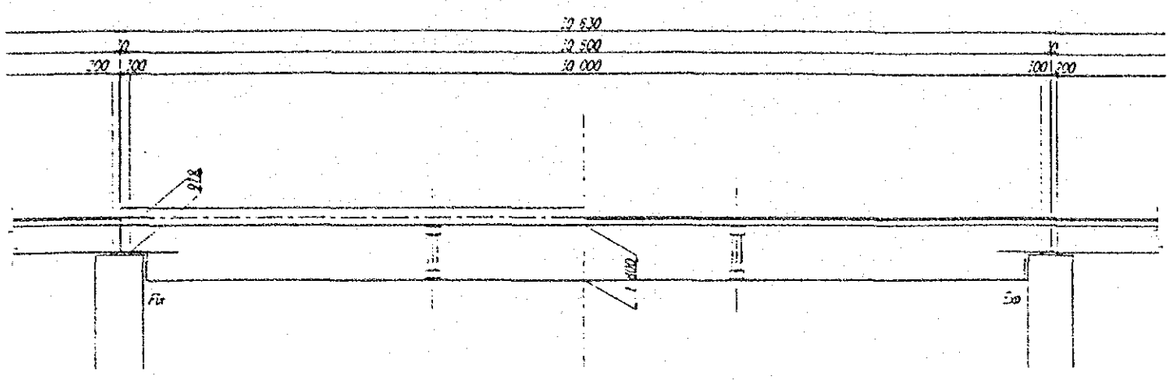


PLATE GIRDER BRIDGE (SPAN 25m)

SUPERSTRUCTRE CROSS SECTION

NO. II.01

FIGURE 6.4-1F GENERAL VIEW (GROUP II)



GENERAL ELEVATION

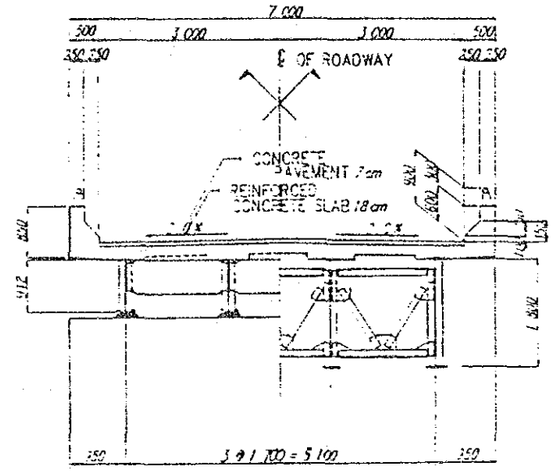
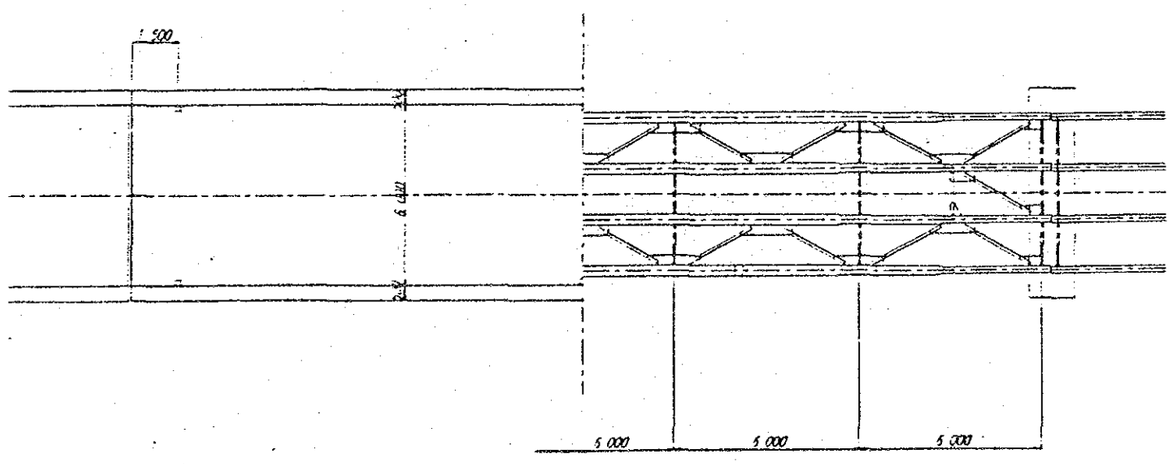


PLATE GIRDER BRIDGE (SPAN 30m)

SUPERSTRUCTRE CROSS SECTION



GENERAL PLAN

FIGURE 6.4-1G GENERAL VIEW (GROUP II)

TABLE 6.4-1 Main Girder Section and Stress (Group II)

Span (m)	15	20	1) 20	2) 20	23	25	30
Roadway Width (m)	7	6	7	7	7	7	6
Girder Type	H-Beam	H-Beam	H-Beam	H-Beam	PI-Girder	PI-Girder	PI-Girder
Depth of Girder	H890 x 299	H912 x 302	H912 x 302	H912 x 302	1600 Web Height	1700 Web Height	1800 Web Height
Steel Grade	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50	SMA50
Moment of Inertia (cm^4)	345000	498000	498000	498000	1349030	1640580	1569000
Area of Cross-Section (cm^2)	270.9	364.0	364.0	364.0	302.4	324.6	298.8
Section Modulus (cm^3)	7760	10900	10900	10900	16412	18814	17073
Plastic Section Modulus (cm^3)	8910	12500	12500	12500	--	--	--
Service Load (t.m)	145.3	158.4	182.1	180.2	297.2	340.3	340.9
Maximum Design Load (t.m)	258.1	269.8	313.5	310.1	506.1	574.4	533.6
Stress (kg/cm^2)	1872	1453	1670	1653	1811	1809	1997
Allowable Stress (kg/cm^2)	2100	21000	2100	2100	2100	2100	2100
Maximum Bending Strength (t.m)	320.8	450.0	450.0	450.0	590.8	677.3	614.6
Service Load (t)	42.7	33.5	38.6	38.2	54.2	56.7	46.7
Maximum Design Load (t)	77.4	57.9	67.5	66.7	93.4	96.8	76.6
Stress (kg/cm^2)	337	221	254	251	376	371	288
Allowable Stress	1200	1200	1200	1200	1200	1200	1200
Maximum Shear Force (t)	250.7	300.8	300.8	300.8	285.1	301.9	320.8
Deflection	1/909	1/882	1/838	1/838	1/821	1/835	1/840
Allowable Deflection	1/800	1/800	1/800	1/800	1/800	1/800	1/800

Remarks: 1) Bridge No. 01.01, 04.01, 04.02, 05.03
2) Bridge No. 05.01, 15.07

Table 6.4-2 Superstructure Reactions for One Abutment (Group II)

Span (m)	Roadway Width (m)	Vertical Reaction (t)			Wind (t) (Horizontal)
		Dead Load	Live Load	Total	
15	7	62.3	54.8	117.1	2.15
20	6	77.8	55.6	133.4	2.55
20	7	86.6	58.6	145.2	2.89
23	7	99.1	60.3	159.4	4.53
25	7	107.8	61.1	168.9	5.11

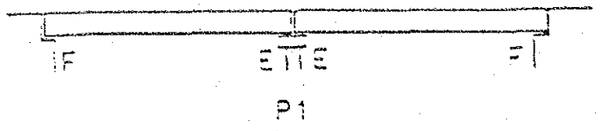
Table 6.4-3 Superstructure Reactions for One Pier (Group II)

Bridge No.	Span (m)	Roadway Width (m)	Pier Number(*)	Vertical Reaction (t)			Wind (t) (Horizontal)
				Dead Load	Live Load	Total	
01.01 04.01 04.02	2 @ 20	7	P1	173.3	66.8	240.1	5.79
02.05	2 @ 23	7	P1	198.3	73.3	271.6	9.06
05.01 15.07	15 + 20 + 15	7	P1.P2	148.9	61.4	210.3	5.04
05.02	4 @ 20	6	P1-P3	155.6	60.8	216.4	5.10
05.03	3 @ 20	7	P1.P2	173.3	66.8	240.1	5.78
11.01	15 + 25 + 15	7	P1.P2	170.1	66.9	237.0	7.27
14.02	20 + 20 + 30 + 20 + 20	6	P.1.P4	155.6	60.8	216.4	5.10
			P2.P3	190.8	70.2	261.0	8.39

(*): Refer to Figure 6.4.2

Remark of TABLE 6 : Pier NO.

NO.01.01 04.01 04.02



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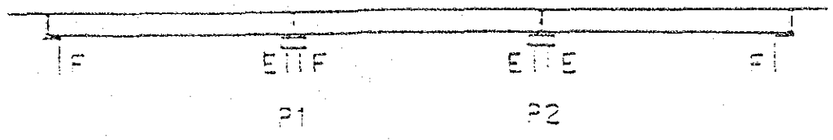

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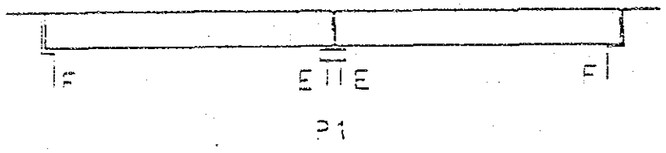
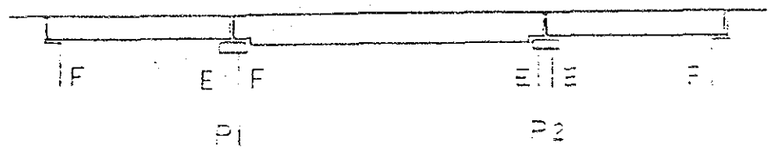
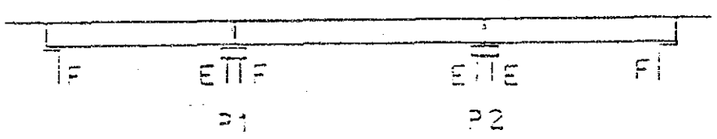


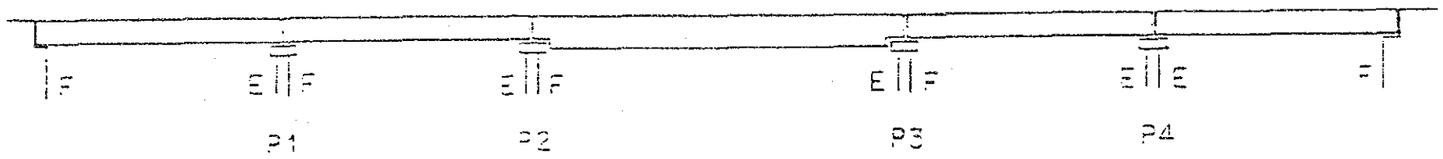
NO.11.01



NO.05.01 15.07



NO.14.02



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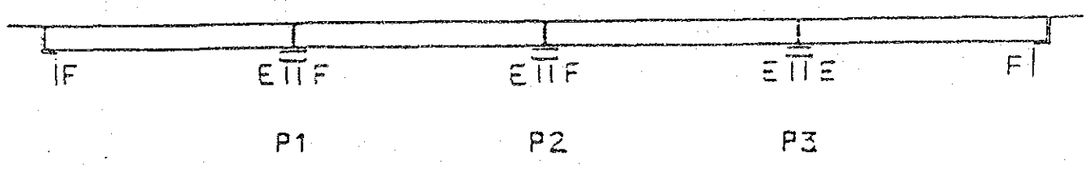


F: FIX
E: EXP

6.5 Substructure Design

6.5.1 Design Criteria

Design Specifications:	AASHTO, Standard Specifications (13th Edition, 1983)
Wind Load:	150 kg/m^2
Concrete:	fc' = 210 kg/m^2 (fca = 70 kg/cm^2)
Reinforcement steel:	fy = 2,400 kg/cm^2
	(fa = 1,200 kg/cm^2 for Plain Bar)
	(fa = 1,400 kg/cm^2 for Deformed Bar)
Backfill Soil:	δ = 1.8 t/m^3, ϕ = 30°
	Surcharge 1t/m^2

6.5.2 Substructure

Figures 6.5-1 shows general views of the abutments and piers of bridges in Group II.

Table 6.5-1 lists the substructures.

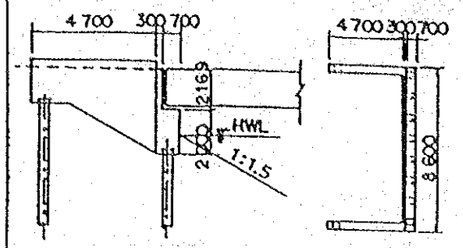
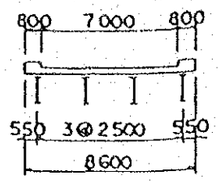
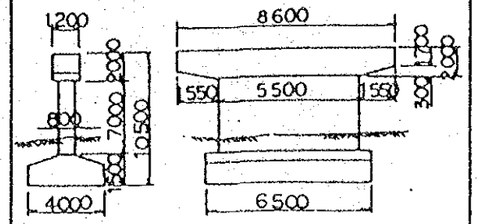
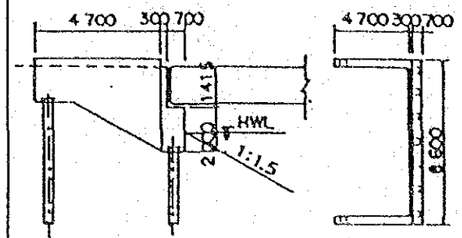
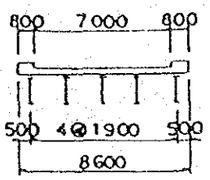
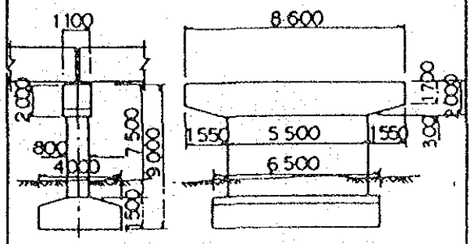
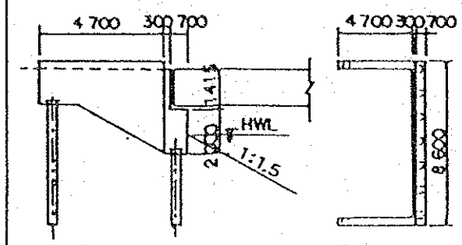
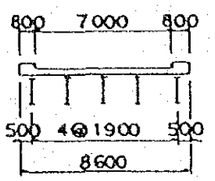
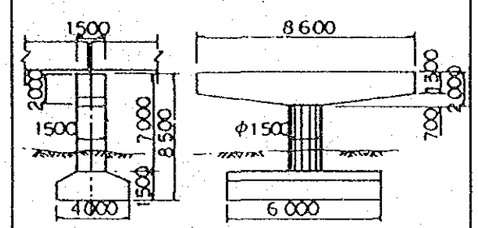
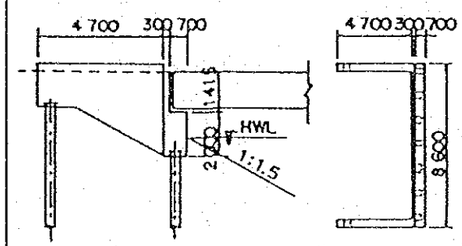
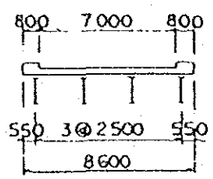
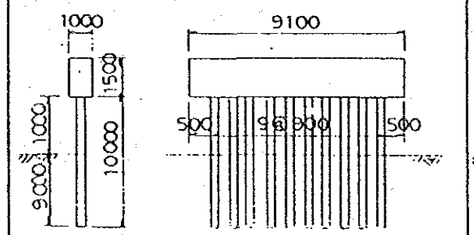
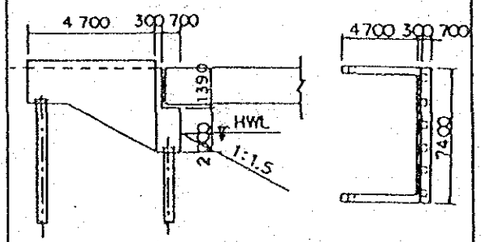
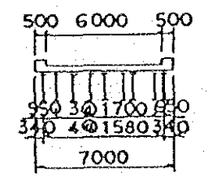
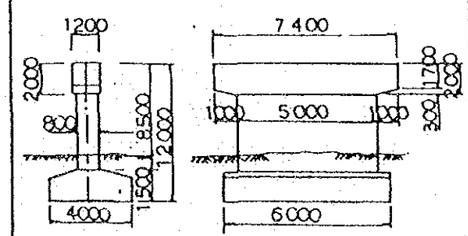
Bridge No.	Bridge Length	Abutment Form figure	Superstructure section figure	Pier Form figure
02-05	47.09 (2@23.0)			
04-01	40.89 (2@20.0)			
04-02	40.89 (2@20.0)			
11-01	56.42 (15.0+25.0 +15.0)			
14-02	112.38 (20.0+20.0 +30.0+20.0 +20.0)			

FIG. 6.5-1 (1)

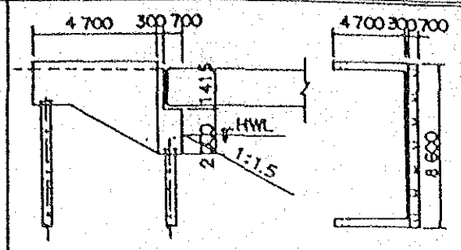
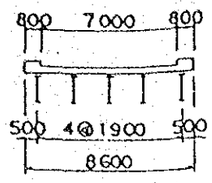
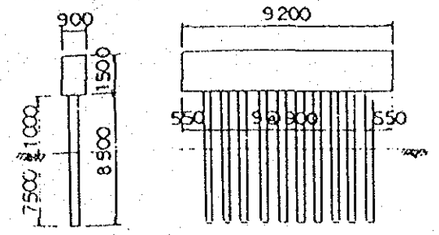
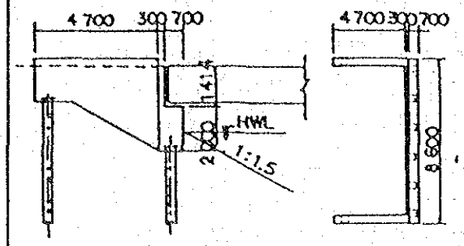
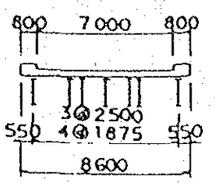
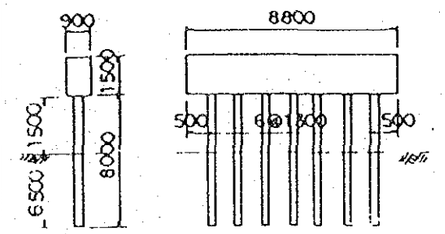
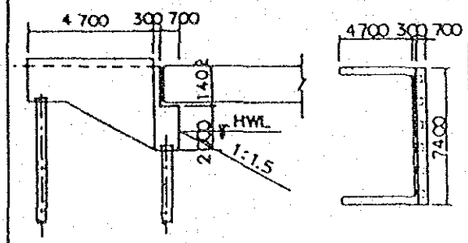
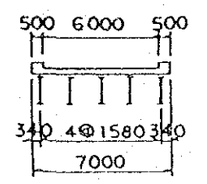
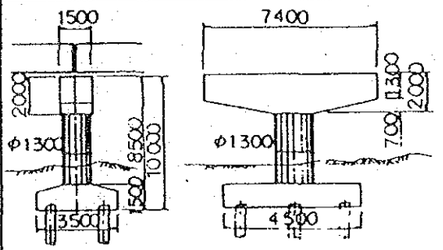
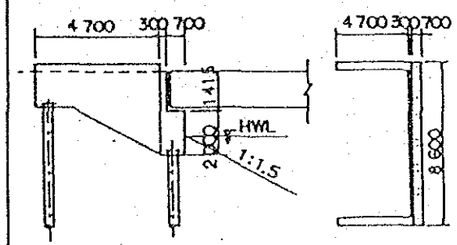
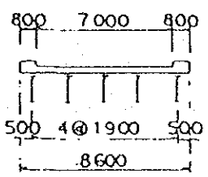
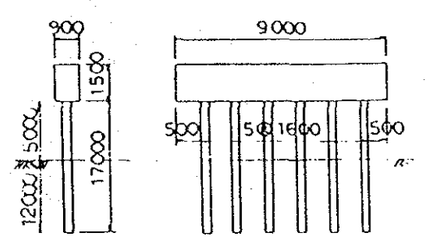
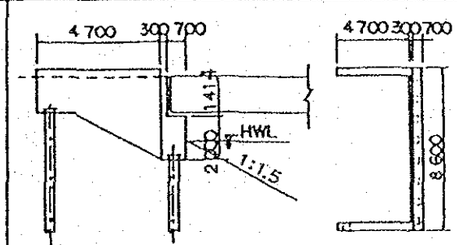
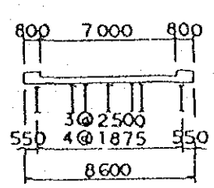
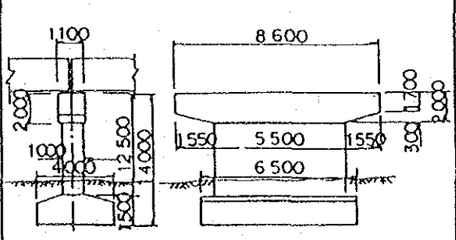
Bridge No.	Bridge Length	Abutment Form figure	Superstructure section figure	Pier Form figure
01-01	40.89 (2@20.0)			
05-01	51.32 (15.0+20.0 +15.0)			
05-02	81.75 (4@20.0)			
05-03	61.32 (3@20.0)			
15-07	51.32 (15.0+20.0 +15.0)			

FIG. 6.5-1 (2)

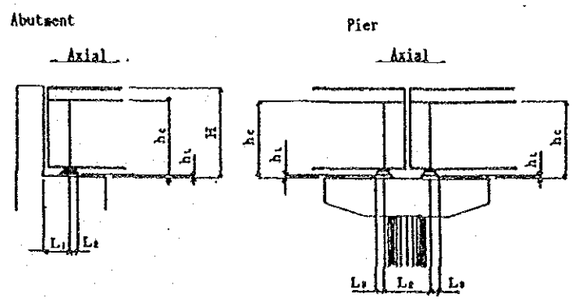
Table 6.5-1 Substructure List

No.	Bridge length (m)	Roadway width (m)	Form	Span	Abutment (t)		Pier (t)		H (mm)	L_1 (mm)	L_2 (mm)	L_3 (mm)	h_L (mm)	hc (mm)
					V (VD)	Hw	V (VD)	Hw						
02-05	47.09	7.0	PL-G	2@23	159.4 (99.1)	4.53	271.6(198.3)	9.06	2169	280	530	170	50	1919
04-01	40.89	7.0	H	2@20	145.2 (86.6)	2.89	240.1(173.3)	5.78	1415	230	430	140	50	1175
04-02	40.89	7.0	H	2@20	145.2 (86.6)	2.89	240.1(173.3)	5.78	1415	230	430	140	50	1175
11-01	56.42	7.0	H+PL-G	15+25+15	117.1 (62.3)	2.15	237.0(170.1) 237.0(170.1)	7.27 7.27	1415	230	430	140	63 50	1165 1165
14-02	112.38	6.0	H+PL-G	20+20+30+20+20	133.4 (77.8)	2.55	216.4(155.6) 261.0(190.8) 261.0(190.8) 216.4(155.6)	5.10 8.39 8.39 5.10	1390	230	430 530 530 430	140	50	1150
01-01	40.89	7.0	H-Beem	2@20	145.2 (86.6)	2.89	240.1(173.3)	5.78	1415	230	430	140	50	1175
05-01	51.32	7.0	H-Beem	15+20+15	117.1 (62.3)	2.15	210.3(148.9) 210.3(148.9)	5.04 5.04	1414	230	430	140	62 50	1164 1174
05-02	81.75	6.0	H-Beem	4@20	133.4 (77.8)	2.55	216.4(155.6)	5.10	1402	230	430	140	50	1162
05-03	61.32	7.0	H	3@20	145.2 (86.6)	2.89	240.1(173.3)	5.78	1415	230	430	140	50	1175
15-07	51.32	7.0	H-Beem	15+20+15	117.1 (62.3)	2.15	210.3(148.9) 210.3(148.9)	5.04 5.04	1414	230	430	140	62 50	1164 1174

V =Vertical force (Deadload+Liveload)

VD=Vertical force (Deadload)

Hw=Wind load



6.6 Approaching Road Design

6.6.1 Design Criteria

There is no criteria for designing rural roads that are managed and maintained by PWD. Therefore, a special design standard for approaching roads has been provided for the project after discussions between engineers of both countries.

The standard has been made by considering traffic volume and the conditions of existing access roads to bridges, and anticipating using in the near future.

The main descriptions of the standard are as follows:

Design Speed			60	km/hr
Road Width	for 2 lanes	Case 1	7.0	m
		Case 2	6.0	m
Shoulder Width	for 2 lanes	Case 1	0.8	m
		Case 2	0.5	m
Grade within bridge			0	%
Minimum Horizontal Radius			50	m
Maximum Grade			5	%
Minimum Vertical Curve Length (Bridge Length)/2 not less than			30	m

1. Approaching roads may be upgraded to improve the vertical alignment in the near future so that the grade in part of the bridge may assume zero percent to assure flexibility for the improvement of vertical alignment of approaching roads.

2. The traffic consists of cultivators with low-power engines and cow-carriages. Therefore, 5% of the maximum grade is adopted, while about 8% of the grade is used on national and provincial highways.

6.6.2 Cross-Section

Sub-grade materials for approaching embankments will be provided near the site of each bridge.

Laterite for the embankment surface and selected materials for the embankment sub-base are basically procured at the site where the proposed bridge is located.

6.6.3 Slope Protection Around Abutment

To prevent scouring or erosion caused by the river during flooding or heavy rains in the rainy season, a slope protection shall be designed for the surface of the slope according to PWD's criteria. The slope protection should be provided with concrete-rock slope protection.

The area of the protection should cover the front of the abutment and both sides of the slope (five meters from the back wall to the end of the wing walls).

6.7 River Upgrading Design

There is no need to protect the topsoil on the slope surface of river embankments in the northeast region because of the low speed of the flow. However, to protect the proposed bridge after completion, some rivers should be upgraded. PWD will determine whether to upgrade or not.

6.8 Implementation Plan

6.8.1 Transportation

The bridge materials and construction equipment should be transported from Bangkok to each bridge site directly after unloading at Bangkok port (since there are no suitable stockyards near Bangkok port).

Damage to public and private facilities caused by the bridge materials or construction equipment during transport should be replaced or repaired. Transportation should be done using trucks and trailers.

Basically, materials and construction equipment should be transported on trailers with a max. load capacity of 25 tons and max. length of 15 meters.

6.8.2 Stage (Temporary Bridge for Construction)

The general specifications of the stage and platform are as follows:

Width of structure	Stage	6m
	Platform	6m
Pavement		non
Deck	Steel Deck	(H + plate)
Main girder	H - 390 x 300	
Pier / pile	H - 300 x 300	
Span length		6m

The specifications of all bridges are as follows:

Bridge	Length of Stages (meters)	Number of Platforms
01.01	0	0
02.05	48	1
04.01	0	0
04.02	0	0
05.01	0	0
05.02	42	1
03.03	48	2
11.01	48	0
14.02	60	0
15.07	42	2
Total	288	6

6.8.3 Pile Foundation

Reinforced concrete piles should be used for pile foundations. Driving piles may be worked out on the natural ground or a platform.

The number of foundations using piles are as follows:

Bridge	Abutment	Pier
01.01	2	1
02.05	2	-
04.01	2	-
04.02	2	-
05.01	2	2
05.02	2	3
05.03	2	2
11.01	2	2
14.02	2	1
15.07	2	-

6.8.4 Coffer-dam

In 8 rivers, there are much water even in the dry season. Substructures and foundations may have to be constructed in the rainy season due to the short construction period. For this reason, a coffer-dam should be provided for some bridges. For the coffer-dams, steel sheet pile will be used because the rivers are relatively narrow.

The two types of coffer-dam are adopted respectively to spread footing and to foundation piles. For the spread footing foundation, a special type of coffer-dam is adopted because steel sheet pile cannot be driven. For the foundation piles, another type of coffer-dam of steel sheet pile is used because they are easily driven.

Steel sheet piles should be driven by vibro driving hammer. Type and number of cofferdam are as follows;

Bridge	Type	Number
02.05	Double type	1
04.01	Double type	1
04.02	Double type	1
05.02	Single type	3
15.07	Double type	2

6.8.5 Scaffolding and Falsework

Platforms or coffer-dams are provided for most bridges, so the use of these temporary structures for scaffolding and falsework is recommended.

6.8.6 Erection of the Steel Girders

When there is a field splice for girders, connection work should be done near the bridge sites, after which the steel girders will be placed on the appropriate substructure by using a crawler crane. Field splices are required for girders more than 15 meters. For built-up plate girders (max. length 30m), temporary supports shall be provided for erection.

Steel girder members may be up to 15.5 meters long and weigh up to six tons.

Platforms will not be available when steel girders are erected, so erection work should be done by placing the crawler cane on the stage.

6.8.7 Suspended Scaffolding for Concrete Deck Work

Even during the dry season, a certain water level at the proposed bridge sites is expected so suspended scaffolding should be used for the concrete deck work in the rainy season.

For fixing suspended scaffolding to the girders, special devices must be set beforehand on the upside of the web plate of the girder.

6.8.8 Concrete Work for Concrete Deck

The concrete work should be divided into two parts: the roadway deck and the sidewalk.

After casting and curing the concrete for the roadway deck, anchor bolts for the railing shall be set into position, then the sidewalk concrete shall be cast.

6.8.9 Demolition of Existing Bridges

Existing bridges are to be demolished by PWD. Some bridges may be demolished before construction is started or during construction by the Japanese contractor.

These timber bridges are as follows;

01.01	After stage	completion
02.05	After stage	"
04.02	After stage	"
05.03	After stage	"
15.07	After stage	"

6.8.10 Approaching Roads

Approaching embankments should generally be constructed after the bridges are completed.

Areas where embankments are to be constructed must be examined carefully by the contractor. Such examination should include a review of the materials report, as well as an on-site inspection when clearing sub-grade materials of the approaching embankment near the site of each bridge. Then, a preliminary investigation of the materials should be conducted before construction starts. The land for such materials may be privately owned. Therefore, negotiations with the land owner must be done at the start of construction to obtain mutual agreement.

The CBR of the main body shall be more than 4%. A preliminary study shall be conducted for compaction work.

The strength of the soil is directly affected by compaction. The less the compaction, the lower the strength when the soil is saturated. It is the contractor's responsibility to obtain the required CBR.

Existing ground surfaces may be unsuitable as a sub-grade material so that existing ground shall be excavated by 50 centimeters for approaching embankments in principle.

The CBR of selected embankment materials shall exceed 8% and be 50 centimeters thick.

The CBR of laterite surfaces shall exceed 30% and be 20 centimeters thick.

Preliminary investigations on selected materials and laterite are required at the start of construction.

6.8.11 Slope Protection of Approaching Embankments

Slope protection of concrete rock should be applied on the slope surface around abutments only.

The protection footing of reinforced concrete should be provided with a toe trench on the bottom of the rip-rap of reinforced concrete.

6.8.12 River Upgrading

PWD may determine whether river upgrading is necessary.

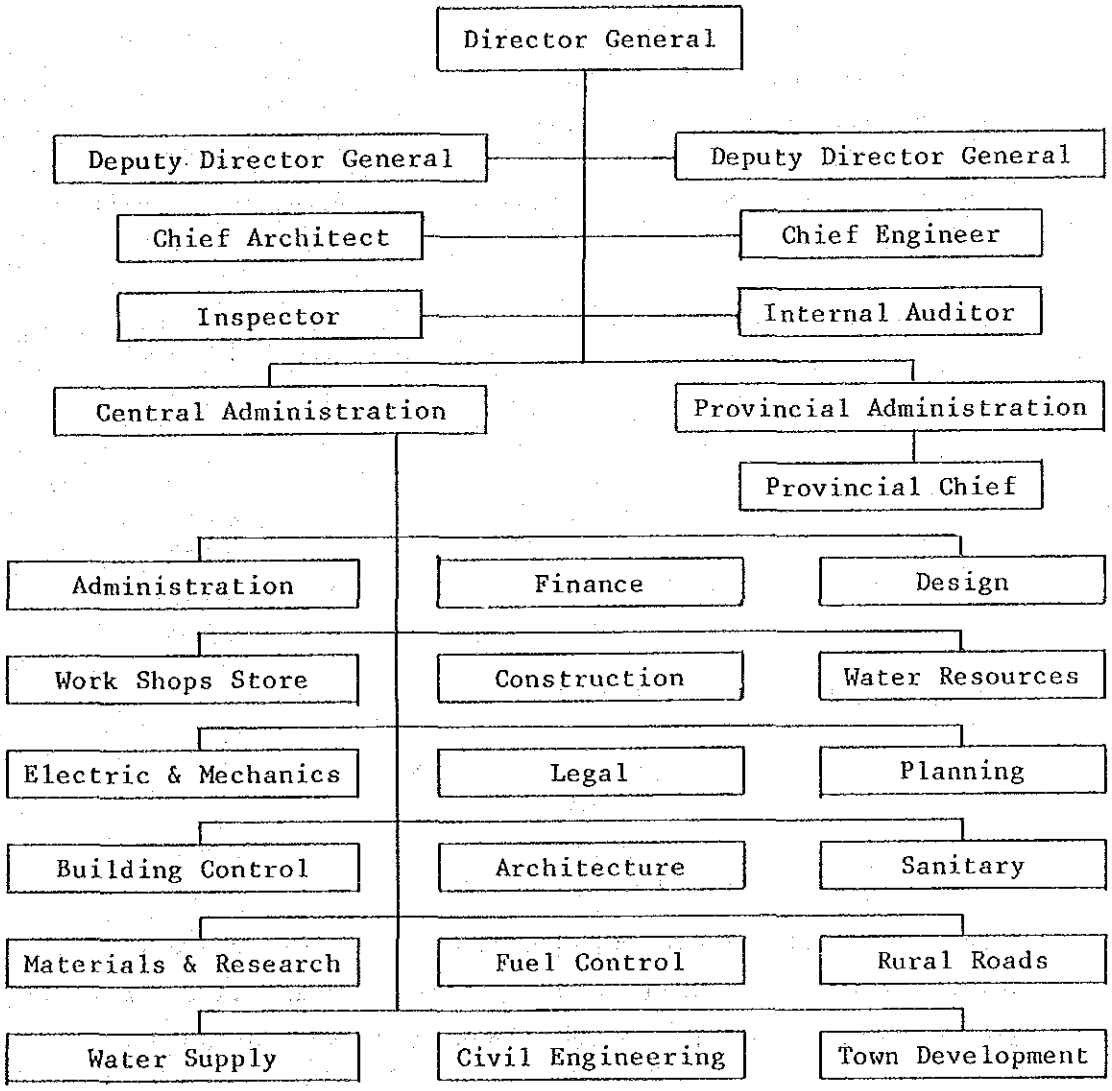
CHAPTER 7
IMPLEMENTING ARRANGEMENT

CHAPTER 7 IMPLEMENTING ARRANGEMENT

7.1 Executing Authority and Organization

The Public Works Department (PWD) is the executing authority for constructing bridges in the northeast region. PWD is headed by a director general who is assisted by two deputy directors, seven directors, and eighteen division directors.

PWD is organized as follows:



The Rural Road Division (RRD) is one of the main divisions in charge of planning, design, construction and maintenance of the proposed bridges.

During bridge construction and maintenance, the RRD will dispatch their experienced bridge engineers to the project sites, and will be supported by 15 PWD provincial offices in the northeast region.

RRD consists of the five sub-divisions listed below.

Administration Section
Technical Sub-division
Construction Sub-division
Maintenance Sub-division
Mechanical Sub-division

The budgets (1984 to 1988) for the Rural Road Division are as follows:

Fiscal Year	Road Construction		Bridge Construction		
	Length(km)	Cost(MB)	Number	Length(m)	Cost(MB)
1984	300	128	50	1079	45
1985	277	187	55	1085	45
1986	293	134	73	1302	54
1987	189	126	75	1641	56
1988	340	156	63	1084	44

7.2 Undertaking of Both Governments

7.2.1 Description

Refer to Appendix 3 for the proposed bridges of Groups I and II. The total length of Group I bridges is 999 m and of Group II 585 m. The superstructure is of simple supported and non-composite steel girders.

7.2.2 Japan's Portion

--- Group I ---

1. Supply of materials for superstructures

Steel girders	1,186 t
Bearing shoes	518 units
Railings	2,818 m
Expansion joints	869 m
Drainage clinices	248 units
Torque wrench/calibrators	31 units/7 units

2. Transportation of materials to stockyards in northeast region
3. Detailed design of superstructure

--- Group II ---

1. Transportation materials and machineries to sites
2. All construction work for ten bridges
3. Construction of approaching embankments
4. Construction of slope protection
5. Detailed design and supervision

7.2.3 Thailand's Portion

--- General ---

Refer to the UNDERTAKINGS by The GOVERNMENT of THAILAND mentioned in the MINUTES of DISCUSSION for details.

--- Group I ---

1. Budgetary allocation for the project
2. Estimating project cost and selecting constructors
3. Preparation of stockyards for supplied materials
4. Construction of substructures
5. Erection of superstructures
6. Construction of concrete decks, railings, expansion joints and drainage clinices.
7. Construction of approaching roads
8. Construction of upgrading rivers
9. Maintenance of bridges

--- Group II ---

11. Maintenance of bridges

7.3 Implementing Schedule

The number and classification of bridges are as follows:

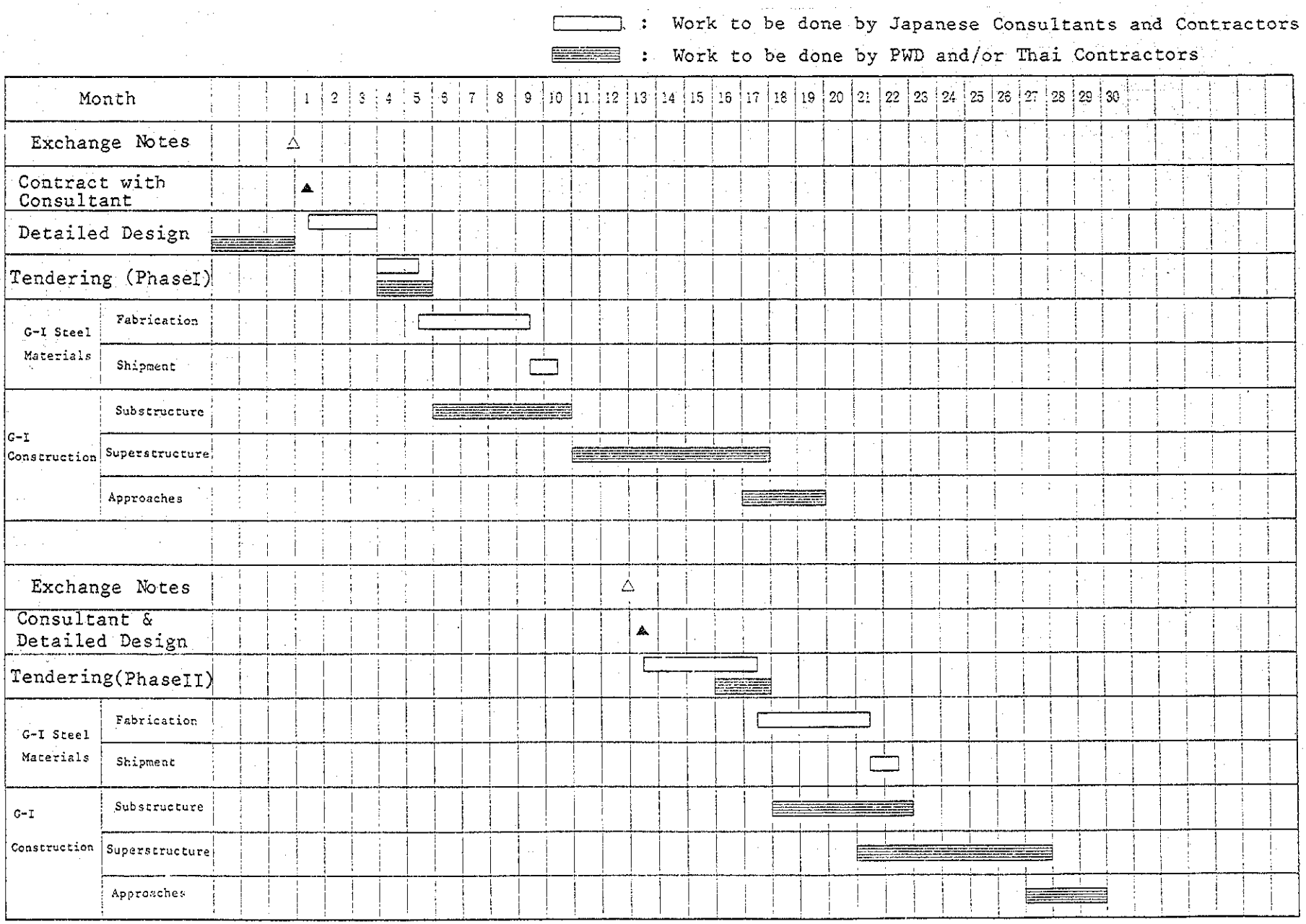
Phase 1	Group I	15 bridges
	Group II	5 bridges
Phase 2	Group I	26 bridges
	Group II	5 bridges

The estimated number of months for each stage are as follows:

E/N		-
Detailed design		2.5 months
Tendering	Phase I	1.5
	Phase II	1.5
Construction of substructures	Phase I	5 - 6
	Phase II	5 - 6.5
Construction of superstructure	Phase I	6 - 7
	Phase II	5 - 7
Approaches	Phase I	3
	Phase II	3

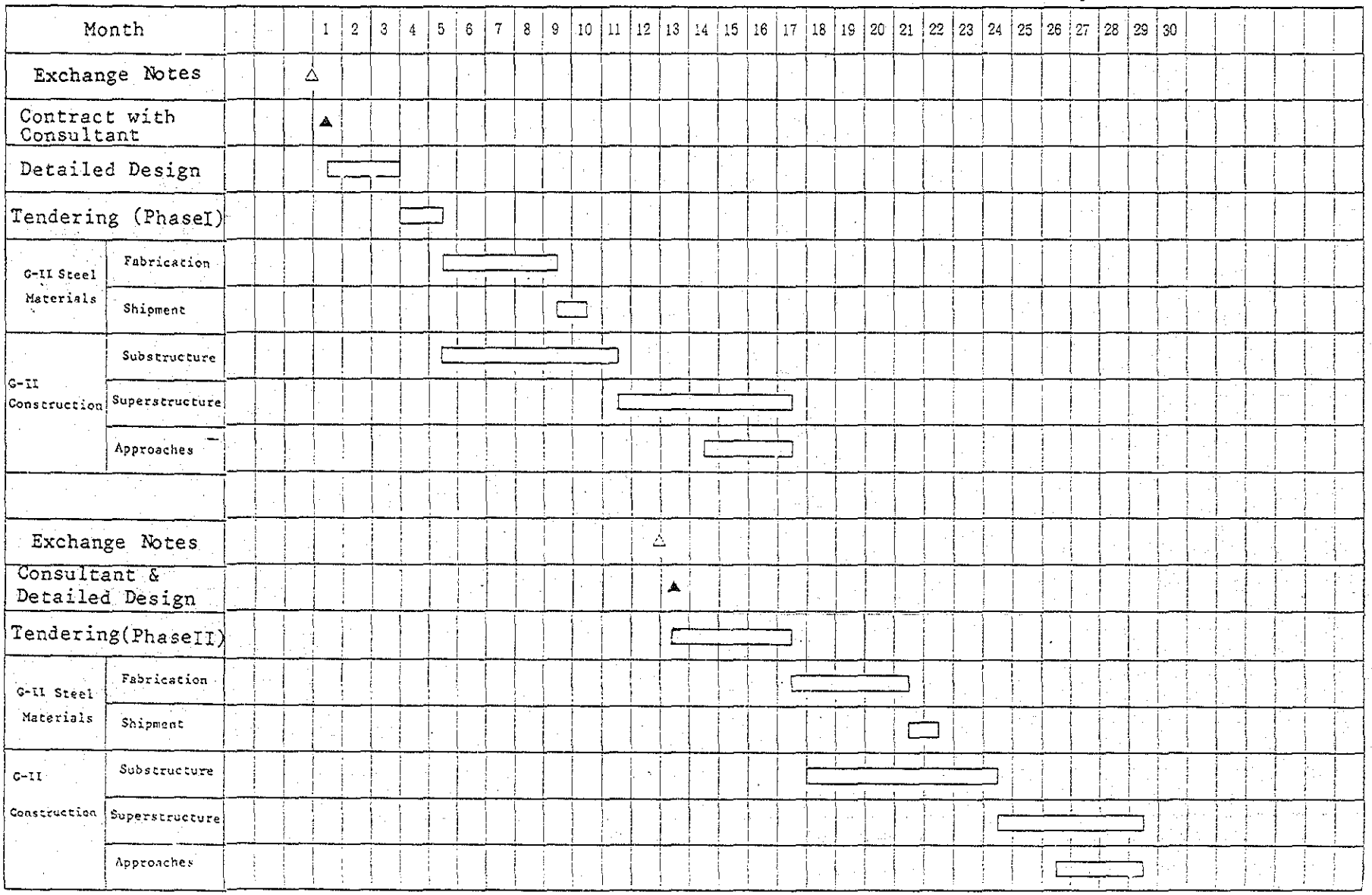
The proposed implementation schedule is shown below.

Tentative Implementation Schedule (Group I)



Tentative Implementation Schedule (Group II)

** Contract with Consultant and Tendering shall be done by PWD



7.4 Budgetary Allocation

The budgetary allocated for the project by the Thai government is approximately one-hundred million baht.

According to the budgetary allocation plan, the budget for the project is as follows:

Group I	Phase I	39.0 million baht
	II	40.2
Group II	Phase I, II	13.4
Total		92.6

Thailand's fiscal year is from the beginnin of October to the end of September of the following year.

The budget should be changed depending upon the period of Exchange of Notes between both countries.

The budget of 1989 includes the preparation of stockyards at Khon Kaen and Ubon Ratchathani.

7.5 Design and Supervision Plan

The project should be executed under the budgetary program of the Thai government and Japan's Grant Aid Program.

7.5.1 Detailed Design

The detailed design should be done as follows:

Group I	Superstructure	Japanese consultant
	Substructure & others	PWD
Group II		Japanese consultant

7.5.2 Contractors

All Group I bridges will be constructed by local contractors; all Group II bridges by Japanese contractors.

7.5.3 Supervision

All Group I bridges shall be supervised by the Provincial Public Works Office; and Group II bridges by Japanese consultants.

The Japanese consultants responsible for the detailed design and supervision of bridge construction, and the Japanese contractors responsible for bridge construction shall be assigned by PWD.

7.6 Maintenance Plan

7.6.1 Present Situaiton of Maintenance

The Rural Road Division of PWD is responsible for the nationwide maintenance of bridges in rural roads. In order to this work, PWD has two construction maintenance centers at Khon Kaen and Ubon Ratchathani.

Timber bridges are easily damaged by flood and representatives of local communities monitor the bridges after flooding occurs. At the end of the rainy season, these representatives submit damage reports to the PWD provincial offices. On the other hand, PWD usually does perform maintenance on permanent bridges.

7.6.2 Maintenance Manual

The maintenance manual to be provided by PWD after the project is completed shall cover the followings:

1. Time/period and frequency of bridge inspection
2. Place/item to be inspected
3. Method of inspection
4. Evaluation after inspection
5. Countermeasures for evaluation

CHAPTER 8
EVALUATION OF THE PROJECT

CHAPTER 8 EVALUATION OF THE PROJECT

This project is aims at the development of the northeast region of Thailand. Therefore, the Government of Thailand has placed top priority on this project. According to the development plan of Thai government, the project is evaluated as follows:

Deteriorated bridge are not only an obstacle to traffic, but also inhibit (directly and indirectly) economic development in rural areas. Reduction of investments by private enterprises and hinderance of development incentives in development have occurred. The completion of this project is expected to ensure a means of transportation, and facilitates the economic development of rural areas. In particular, improved transportation facilities will contribute considerably to improving productivity and developing a social life in the region.

Accordingly, the impact of this project should be evaluated not only from a traffic aspect but also socio-economic.

(1) Direct Impact

The direct impact of this project should be evaluated by the road users and the government. For road users, the impact will be measured in terms of reduced transportation costs and time, and fewer traffic accidents. For the government, the impact will be measured by reduction in maintenance and repairing costs.

The impact of this project is measured as follows:

1) Ensuring reliable traffic during the rainy season
2) Reduction of transportation cost and time
3) Safe transport of heavy trucks and machineries
4) Improvement of function of rural road networks
5) Improvement of traffic safety
6) Convenience for transportion of agricultural products
7) The benefits for 580,000 regional residents

(2) Indirect Impact

The indirect impact of this project can be evaluated from a socio-economic point of view.

The followings are taken as evaluation of indirect impact:

1) Improvement of living level
2) Encouragement of social activities
3) More employment opportunities
4) Allevigation of regional inequality
5) Stabilization of consumer prices
6) Promotion of agricultural and industrial productions
7) Promotion of investment incentives of private enterprises

This project will contribute to creation of employment opportunities for residents and to increase of good communication among rural residents.

CHAPTER 9
CONCLUSION AND RECOMMENDATION

CHAPTER 9 CONCLUSION AND RECOMMENDATION

9.1 Conclusion

The objectives of this project are to replace some deteriorated timber bridges along rural roads in the northeast region of Thailand with permanent bridges, to improve rural traffic conditions, and to assure the means of transportation.

In The Sixth Five-Year National Economic and Social Development Plan (1987 to 1991), Thai government has placed a clear plan to promote regional development for backward areas. The Thai government has placed great importance on road repair and construction.

This project is expected to achieve the objectives of the above development plan, by promoting rural development, increasing employment opportunities, and contributing to economic growth. For this reasons, this project should be implemented through Japan's Grant Aid Program.

9.2 RECOMMENDATIONS

According to the present situaiton, this project be completed as soon as possible. In order to complete this project and achieve the stated objectives it is required to the Thai government to establish the following measures:

(1) Securing a budget and establishing an organization capable for this project

This project should be implemented under the control of Public Works Department, Ministry of Interior. The director general of PWD is responsible for promoting this project, and will secure the budget and assign the necessary engineers to various positions to ensure the smooth execution of the project.

(2) **Before implementing this project, the following matters should be resolved:**

- Acquisition of necessary land
- Removal of obstructing houses and other facilities, etc.
- Preparation of land needed for construction
- Maintenance and repair of roads for transportation
- Construction of access roads
- Preparation of stockyards

(3) **After completing this project**

- Maintenance and Management
- Others

a) Road registration under PWD

Route Numbers

Beginning and end points of Routes

Kilo-meter Posts

Road list

b) Bridge registration under PWD

Name, length, type, construction date, etc.

APPENDIX

APPENDIX 1

- Members and Itinerary of the Basic Study
- List of Persons Met
- Minutes of Discussions

1. Members and Itinerary of the Basic Study Team

1.1 Members

Leader	: Mr. Hiroyuki Nakajima	Deputy Managing Director, Higashi-Kobe Construction Office Hanshin Expressway Public Corporation
Bridge Planning	: Mr. Takashi Yamanaka	Head of Traffic Engineering Division Second Operation Bureau, Honshu-Shikoku Bridge Authority
General Planning	: Mr. Akira Ouchi	Staff, Grant Aid Division, Economic Cooperation Department, Ministry of Foreign Affairs
Bridge Construction Planning	: Mr. Takayoshi Ono	Chiyoda Engineering Consultants Co., Ltd.
Bridge Design	: Mr. Takashige Kanamori	"
"	: Mr. Jiro Ishikawa	"
Construction Planning	: Mr. Kei Tani	"
Cost Estimation	: Mr. Shuichi Takahashi	"
Topographic Survey	: Mr. Satoshi Yamamura	Katahira & Engineers Inc.
Geological Survey	: Mr. Yoshihiro Goto	"

2 Persons Met

Advisery Committee

Mr.Niyom Niyamanusorn	-Director General, Public Works Department
Mr.Seree Suthamchai	-Chief Engineer
Mr.Anusoranand Mahavinichaimontri	-Director, Materials and Research Division
Mr.Somphop Unhawat	-Director, Rural Road Division
Mr.Mana Chotikapanich	-Director, Planning Division
Mr.Methee Hongnoi	-Chief, Soil Engineering Sub-Division
Mr.Kosol Ratanaporn	-Chief, Construction Sub-Division
Mr.Samart Yolpak	-Director, Bridge Construction in Rural Region Project
Mr.Sompong Busabong	-Chief, Construction Section, in Rural Region Project
Mr.Suriya Ratanasamai	-Chief, Design Section, in Rural Region Project

Provincial Public Works Office Representatives

Mr.Praserm Imwiset	-Kalasin
Mr.Samphao Malasi	-Khon Kaen
Mr.Prayoot Thammachari	-Chaiya Phum
Mr.Wichien Tuamsook	-Nakhon Phanom
Mr.Arporn Tawisuwan	-Nakhon Rachasima
Mr.Wirat Limsuwat	-Maha Sarakham
Mr.Ong-at Promchanyakul	-Mukdahan
Mr.Sathaporn Wathnanusi	-Yasothon
Mr.Prachuap Bandithaya	-Roi-et
Mr.Chansamorn Sathapanachai	-Sisaket
Mr.Theeranon Woraprakul	-Sakon Nakhon
Mr.Sumon Rojanasiri	-Surin
Mr.Chamlong Worahan	-Nong Khai
Mr.Sakda Weerakul	-Udon Thani
Mr.Amnat Phakarat	-Udon Ratchathani

Counterparts

Mr.Samart Yolpak	-Director, Bridge Construction in Rural Region Project
Mr.Sompong Busabong	-Chief, Construction Section in Rural Region Project
Mr.Pariyah JItgaroon	-Bridge Engineer, Rural Road Division
Mr.Tanachai Intarasorn	-Civil Engineer, Rural Road Division
Mr.Yingyot Vichienchom	-Civil Engineer, Rural Road Division
Mr.Phonsak Noparat	-Engineer, Planning Division
Mr.Suriya Ratanasamai	-Chief, Design Section in Rural Region Project

Department of Technical and Economic Cooperation

Mr. Achari Yuktanandana	Manager, Department of Technical and Economic Cooperation
Mr. Budhsit Viryasiri	Department of Technical and Economic Cooperation
Mr. Gecha Chaechai	Department of Technical and Economic Cooperation

Japanese Embassy & JICA Office

Mr. Hideo Matuda	First Secretary, Japanese Embassy
Mr. Ben Saitou	Resident Representative Thailand Office, JICA
Mr. Yukihisa Sakurada	Deputy Director Thailand Office, JICA
Mr. Tatsuo Suzuki	Thailand Office, JICA

1.2 Itinerary

18	Jan.	1989	Wed.	· Arrival Bangkok of Study Team
19	〃	〃	Thu.	· Meeting at PWD, Embassy of Japan, JICA
20	〃	〃	Fri.	· Meeting at PWD Main Office · Explanation of Inception Report · Meeting at PWD Rural Division Office
21	〃	〃	Sat.	· Meeting with Local Consultants about Survey and Soil Investigation · Data Analysis
22	〃	〃	Sun.	· Data Analysis · Discussion with Study Team
23	〃	〃	Mon.	· Planning of Working Schedule · Discussion of Substructure Type of Bridges
24	〃	〃	Tue.	· Selection of Proposed Bridges · Review of Data
25	〃	〃	Wed.	· Selection of Proposed Bridges · Calcuration of Rough Materials of Bridges
26	〃	〃	Thu.	· Calcuration of Rough materials of Bridges · Rough Cost Estimation of Bridge Construction · Arrival Bangkok of Messrs. Nakajima, Yamanaka and Ouchi
27	〃	〃	Fri.	· Courtesy Call PWD, JICA, Embassy ofJapan and DTEC · Cost Estimation
28	〃	〃	Sat.	· Site Investigation
29	〃	〃	Sun.	· 〃 〃
30	〃	〃	Mon.	· 〃 〃
31	〃	〃	Tue.	· Hearing from each provincial representatives on the proposed bridges for selection
1	Feb	〃	Wed.	· Cost Estimation of Selecting Bridges · Discussion on Draft of Minutes
2	〃	〃	Thu.	· Discussion with PWD on the final selection of Bridges
3	〃	〃	Fri.	· Signing of Minutes of Discussions
4	〃	〃	Sat.	· Departure of Messrs. Nakajima, Yamanaka and Ouchi · Meeting at JICA, Embassy of Japan
5	〃	〃	Sun.	· Arrangement of Data
6	〃	〃	Mon.	· Review of Working Schedule
7	〃	〃	Tue.	· Discussion with PWD on Site Investigation and Schedule
8	〃	〃	Wed.	· Arrival of Mr. Tani
9	〃	〃	Thu.	· Start of Field Survey and Soil Investigation · Review of Group I and II Bridges · Discussion of Phase I and II
10	〃	〃	Fri.	· Study on each Bridge
11	〃	〃	Sat.	· Discussion for Site Investigation Items
12	〃	〃	Sun.	· Arrival of Mr. Takahashi
13	〃	〃	Mon.	· Site Investigation Start by two Bridge Engineers and Bridge Construction Planner

14	〃	〃	Tue.	・Arrangement of Group Ⅰ Data and drawings
15	〃	〃	Wed.	・Discussion of Questionnaire Items
16	〃	〃	Thu.	・Data collection of Popuration around selected bridges
17	〃	〃	Fri.	・Analysis of Population to use selected Bridges
18	〃	〃	Sat.	・Analysis of Population to use selected Bridges
19	〃	〃	Sun.	・Check of Group Ⅰ Bridge Drawings
20	〃	〃	Mon.	・Revise of Group Ⅰ and Ⅱ Bridges after result with Site Investigation
21	〃	〃	Tue.	・Revise of each bridge length
22	〃	〃	Wed.	・Discussion and Confirmation of Design Standards
23	〃	〃	Thu.	・Revise of Bridge Width. Discussion of Girdrail Type, ・Pavement, Hounch,etc.
24	〃	〃	Fri.	・Trial calcuration to deside Maingirder arrangement
25	〃	〃	Sat.	・Rough calcuration for Substructure stabirity
26	〃	〃	Sun.	・Holiday
27	〃	〃	Mon.	・Team Meeting about Investigation Report
28	〃	〃	Tue.	・Study of Implementing Arrangement of Phase Ⅰ Bridges and Phase Ⅱ Bridges
1	Mar	〃	Wed.	・Final Discussion with PWD and Data Arrangement
2	〃	〃	Thu.	・Meeting at Embassy of Japan, JICA, PWD and DTEC
3	〃	〃	Fri.	・Return to Japan

MINUTES OF DISCUSSIONS
of
THE BASIC DESIGN STUDY ON THE PROJECT FOR BRIDGE CONSTRUCTION IN RURAL REGION
in
NORTHEAST THAILAND

In response to the request made by the Government of the Kingdom of Thailand, the Government of Japan decided to conduct a basic design study on the project for bridge construction in rural region in Northeast Thailand (hereinafter referred to as "the Project") and the Japan International Cooperation Agency (JICA) has sent the Basic Design Study Team headed by Mr. Hiroyuki Nakajima, Deputy Managing Director, Higashi Kobe Construction Office, Hanshin Expressway Public Corporation, from January 26 to February 4, 1989.

The Japanese Team had a series of discussions and exchanged views on the Project with the authorities concerned of the Government of Thailand.

As a result of the study and discussions, both parties have agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Bangkok, February 3, 1989

中島裕之

Hiroyuki Nakajima
Leader of the Basic Design
Study Team,
The Japan International
Cooperation Agency

Niyom Niyamanusorn
Director General
Public Works Department
Ministry of Interior

ATTACHMENT

1. The objective of the Project is to assist the Government of Thailand to improve the socio-economical infrastructure in rural region in Northeast Thailand by supplying materials and bridge members of the superstructure of the bridges specified as Group-I, and by constructing the bridges specified as Group-II.

2. The government agency responsible for the implementation of the Project is the Public Works Department, Ministry of Interior.

3. The bridges subjected to the Project are classified into two (2) groups as follows :

   Group I : Materials and bridge members necessary for the construction of the superstructure of the bridges are supplied from the Government of Japan. The construction of substructure, erection of superstructure and construction of deck slab of the bridges are conducted by the Government of Thailand. (as shown in Annex 1)

   Group II : The construction of substructure and superstructure of the bridges including approaching roads and river bank structure required for the protection of the road embankment around the abutment of bridges are conducted by the Government of Japan. (as shown in Annex 2)

4. The location of the bridges subjected to the Project is shown in Annex 3.

5. Items to be supplied from Japan in Group I are :
   Superstructure members (main girders, cross beams, etc.)
   Bearings
   Rails and posts on the bridges
   Torque wrenches, etc.

6. The Project will be implemented in two phases. (The proposal for phase classification will be done by the Thai side before the end of February.)

7. The Team will convey to the Government of Japan the desire of the Government of Thailand that the former takes necessary measures to cooperate by providing products and services necessary for the execution of the Project within the scope of Japanese economic cooperation programme in grant form.

8. The Thai side has understood the system of Japan's Grant Aid and the necessity of engaging Japanese consulting firm and general contractor for the implementation of the Project.

9. The Government of Thailand will undertake to provide the necessary measures as listed in Annex 4 on condition that a Grant Aid by the Government of Japan is extended to the Project.

A.M.

List of Bridges for Group I

No.	Bridge No.	Name of Bridge	Location
1.	02.02	Huai Nong Ben	Km. 5+200 Ban Kham Bong- Ban Non Dong Man Road (A. Nam Phong)
2.	02.03	Huai Yang	Km. 5+950 Ban Kham Bong- Ban Non Dong Mon Road (A. Nam Phong)
3.	03.01	Huai Khon Tha	Km. 1+100 A. Kaeng Khlo- Ban Nong Khu Road
4.	03.02	Huai Yai	Km. 5+950 A. Kaeng Khlo- Ban Nong Khu Road
5.	03.03	Huai Phai No. 1	Km. 18+500 A. Kaeng Khlo- Ban Nong Khu Road (A. Ban Thaen)
6.	03.04	Huai Phai No. 2	Km. 18+700 A. Kaeng Khlo- Ban Nong Khu Road (A. Ban Thaen)
7.	04.04	Huai Na Khoi	Km. 1+150 Ban Na Khoi- Ban Un Na Road (A. Na Wa)
8.	04.05	Huai Na Krathum	Km. 2+550 Ban Na Khoi- Ban Un Na Road (A. Na Wa)
9.	05.04	Lam Ta Khong No. 1	Ban Nam Mao (Lat Boa Khao, Sikhui)
10.	05.05	Lam Ta Khong No. 2	Ban Mai Samrong (Mai Samrong, Sikhui)
11.	06.01	Huai Sieo	Km. 0+450 Ban Daeng-Ban Bon Thung Road (A. Wapipathum)

List of Bridges for Group I

No.	Bridge No.	Name of Bridge	Location
12.	06.03	Huai Lom Khom No. 2	Ban Lom Khom-Ban Don Daeng Road
13.	06.04	Huai Na	Km. 4+950 Ban Khok-Ban Kok Road (A. Wapipathum)
14.	07.07	Huai Po	Km. 0+450 Rt. No. 212-Ban Kham Mek Road (A. Muang)
15.	07.08	Huai Ngui	Km. 0+850 Rt. No. 212-Ban Kham Mek Road (A. Muang)
16.	08.01	Huai Wang Pla Sium	Km. 0+950 A. Sai Mun-Ban Na Pong Road (A. Sai Mun)
17.	08.02	Huai Na Pong	Km. 2+450 A. Sai Mun-Ban Na Pong Road (A. Sai Mun)
18.	08.03	Huai Khaen	Km. 0+800 A. Kut Chum-Ban Khok Sung Road (A. Kut Chum)
19.	08.04	Huai Khaen Long No. 1	Km. 0+650 A. Kut Chum-Ban Khok Sung Road (A. Kut Chum)
20.	08.05	Huai Khaen Long No. 2	Km. 1+000 A. Kut Chum-Ban Khok Sung Road (A. Kut Chum)
21.	09.01	Huai Pla Pong	Km. 1+700 Ban Non Yang-Ban Sathon Road (A. Selaphum) Ban Nong Chok (A. Selaphum)
22.	09.03	Huai Siao No. 1	Km. 1+725 Rt. No. 214-Ban Hua Nong Road (A. Kaset Wisai)

List of Bridges for Group I

No.	Bridge No.	Name of Bridge	Location
23.	09.04	Huai Siao No. 2	Km. 1+215 Ban I-Khot-Ban Hua Nong Road (A. Kaset Wisai)
24.	10.01	Huai Palan Muang	Ban Sikhunhan-Ban Nong Phu Road
25.	10.02	Huai Kantruat	Ban Sikunhan-Ban Nong Phu Road (A. Khun Han)
26.	11.03	Ban Na Kae	Ban Phon Kangpla-Ban Na Oi Road
27.	12.02	Huai Thamo	Km. 5+625 Ban Prasat Beng- Ban Khu Tan Road (A. Kap Choeng)
28.	13.01	Huai Sieo No. 1	Ban Thewi-Ban Dua Road (A. Tha Bo)
29.	13.02	Huai Sieo No. 2	Ban Thewi-Ban Dua Road (A. Tha Bo)
30.	13.03	Huai Ban Mui	Ban Na Chang Nam- Ban Nong Waeng Road (A. Tha Bo)
31.	13.04	Huai Ran	Ban Na Chang Nam- Ban Nong Waeng Road (A. Tha Bo)
32.	13.05	Huai Bang Phuan No. 1	Km. 0+400 Ban That-Ban Chuak Road (A. Muang)
33.	13.06	Huai Bang Phuan No. 2	Km. 0+775 Ban That-Ban Chuak Road (A. Muang)

List of Bridges for Group I

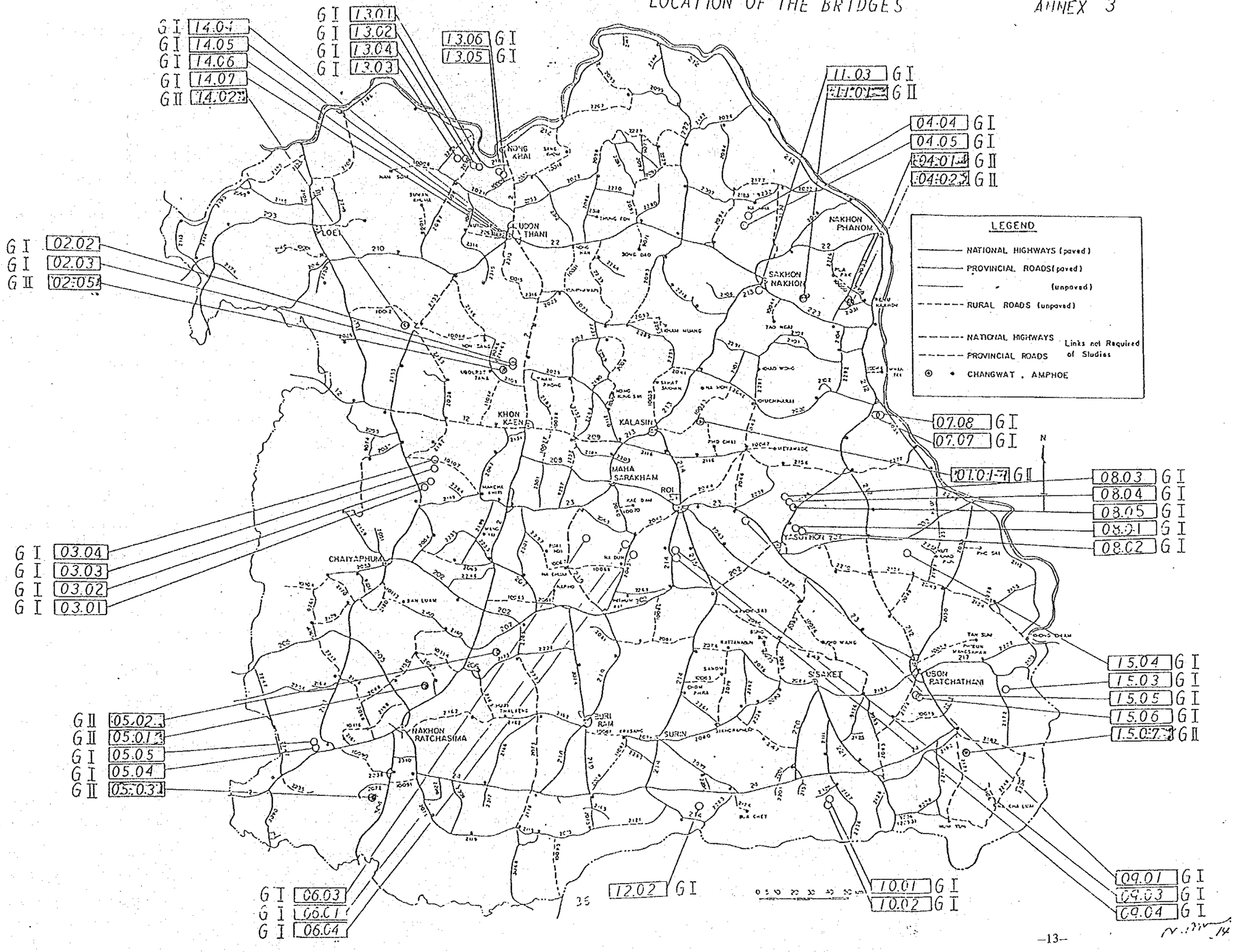
No.	Bridge No.	Name of Bridge	Location
34.	14.04	Nong Bung Mo No. 1	Ban Chiang Yun-Ban Chiang Pheng Road (A. Kut Chap)
35.	14.05	Nong Bung Mo No. 2	Ban Chiang Yun-Ban Chiang Pheng Road (A. Kut Chap)
36.	14.06	Nong Bung Mo No. 3	Ban Chiang Yun-Ban Chiang Pheng Road (A. Kut Chap)
37.	14.07	Nong Bung Mo No. 4	Ban Chiang Yun-Ban Chiang Pheng Road (A. Kut Chap)
38.	15.03	Huai Sa Do	Km. 3+375 Rt. No. 2172-Ban Nong Hai Road (A. Phibun Mang Sahan)
39.	15.04	Huai So Phra	Ban Na Wa-Ban Khok Phra Road
40.	15.05	Huai Choek	Km. 0+350 Ban Nong Hai (Rt. No. 2178-Ban Na Kae Road (A. Samrong)
41.	15.06	Huai Khaen	Km. 4+800 Ban Non Hai (Rt. No. 2178)-Ban Na Kae Road (A. Samrong)

List of Bridges for Group II

No.	Bridge No.	Name of Bridge	Location
1.	01.01	Huai Kae	Ban Kut Khlong-Ban Dan Tae Road
2.	02.05	Huai Khum Mum	Km. 6+250 Ban Huai Sai-Ban Kut Chiang Mee Road (A. Ubol Rattana)
3.	04.01	Huai Soeng No.1	Km. 0+750 Rt. No. 2031-Ban Bo Dok Son Road (A. Na Kae)
4.	04.02	Huai Soeng No. 2	Km. 1+150 Rt. No. 2031-Ban Bo Dok Son Road (A. Na Kae)
5.	05.01	Lam Klang	Ban Dan Khon Khob
6.	05.02	Lam Nam Mum	Ban Kham Klang
7.	05.03	Lam Phra Phloeng	Ban Phla Bung A. Pak Thong Chai
8.	11.01	Lam Nam Kam	Km. 3+200 Ban Khok Kong-Ban Phon Road (A. Muang)
9.	14.02	Lam Nam Phuai	Km. 5+650 A. Si Bun Ruang-Ban Pa Kha Road (A. Si Bun Ruang)
10.	15.07	Lam Som No. 1	Km. 1+225 Ban Na Kae (Rt. No. 2171)-Ban Sao Lao Road (A. Det Udom)

LOCATION OF THE BRIDGES

ANNEX 3



UNDERTAKINGS BY THE GOVERNMENT OF THAILAND

1. To provide necessary data and information for basic design study.
2. To bear commissions to the Japanese foreign exchange bank for the banking services upon the banking arrangement.
3. To ensure prompt unloading, tax exemption and customs clearance at the port of disembarkation in Thailand of all the materials provided under Japan's Grant Aid.
4. To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Thailand with respect to the supply of products and services under the verified contracts.
5. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts to enter into Thailand and stay therein for the performance of their work.
6. To secure the right of way and to provide necessary land area for the construction works.
7. To remove obstacles including houses within the right of way that affects the implementation of the Project.
8. To secure roads leading to the Project sites for the transportation of materials and equipment for the Project.
9. To secure the necessary budget for the construction of bridges in Group I.
10. To construct the bridges in Group I within the period of one year after delivery of materials at designated port of entry provided under the Japan's Grant Aid.
11. To improve access roads connecting from the main roads to the bridges constructed under the Project within a few years.
12. To secure the necessary budget and personnel for the proper and effective maintenance of the bridges to be constructed under the Japan's Grant Aid.

APPENDIX 2

- Members and Itinerary of the Draft Final Report

Members and Itinerary of Draft Final Report Mission

1 Members

JICA Study Team	
Mr. Hiroyuki Nakajima	Team Leader
Mr. Norio Matsuda	Planning Management
Mr. Takayoshi Ono	Bridge Planning
Mr. Jiro Ishikawa	Bridge Engineer
Mr. Kei Tani	Construction Planning
Public Works Department	
Mr. Niyom Niyamanusorn	Director general
Mr. Prajaya Sutabutra	Deputy Director General
Mr. Samreong Komolsiri	Deputy Director General
Mr. Serée Suthamchai	Chief Engineer
Mr. Sompop Unhawat	Director, Rural Road Division
Mr. Mana Chotikapanich	Director, Planning Division
Mr. Samart Yolpak	Director, The Project
Mr. Kosol Rattanaporn	Advisory Committee
Mr. Vichit Saengchan	Director,Procurement Division
Mr. Amnat Pakarat	Chief of Ubon Public Works Office
Mr. Sompong Busabong	Head Construction Section of The Project

2 Itinerary

24	Apr. 1989	Mon.	· Arrival Bangkok of Study Team
25	〃 〃	Tue.	· Meeting at JICA · Meeting at Embassy of Japan · Meeting at PWD Main Office
26	〃 〃	Wed.	· Explanation of Draft Final Report at PWD Main Office
27	〃 〃	Thu.	· Discussion on Draft Final Report and Draft of Minutes of Discussions
28	〃 〃	Fri.	· Signing of Minutes of Discussions
29	〃 〃	Sat.	· Collection of additional data
30	〃 〃	Sun.	· Departure of Study Team

3. Persons Met

Mr. Hideo Matuda	First Secretary, Japanese Embassy
Mr. Ben Saitou	Resident Representative Thailand Office, JICA
Mr. Tatsuo Suzuki	Thailand Office, JICA

MINUTES OF DISCUSSIONS

OF

THE BASIC DESIGN STUDY ON THE PROJECT FOR BRIDGE CONSTRUCTION

IN RURAL REGION

IN

NORTHEAST THAILAND

In response to the request by the Government of the Kingdom of Thailand, the Government of Japan decided to conduct a basic design study on the project for constructing bridges in the rural region in Northeast Thailand (hereinafter referred to as " the Project "). The Japan International Cooperation Agency (JICA) sent the Basic Design Study Team headed by Mr. Hiroyuki Nakajima, Deputy Managing Director, Higashi Kobe Construction office, Hanshin Expressway Public Corporation, from January 18 to March 3, 1989.

As a result of the study, JICA prepared a Draft Final Report and dispatched a team headed by Mr. Hiroyuki Nakajima, Deputy Managing Director, Higashi Kobe Construction office, Hanshin Expressway Public Corporation, to explain and discuss it with the relevant officials of the Government of the Kingdom of Thailand from April 24 to April 30, 1989.

Both parties had a series of discussions on the Report and agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Bangkok, April , 1989

中島裕之

Hiroyuki Nakajima
Leader of the Basic Design
Study Team,
The Japan International
Cooperation Agency

Niyom Niyamanusorn
Director General
Public Works Department
Ministry of Interior

ATTACHMENT

1. The Thai side has agreed to the basic design proposed in the Draft Final Report.

2. The Thai side has understood Japan's Grant Aid System and reconfirmed the necessary measures to be taken by the Government of the Kingdom of Thailand which are manifested in the " Minutes of Discussions " on the Project signed on February 3, 1989, on condition that the Grant Aid by the Government of Japan would be extended to the Project.

3. The Thai side has agreed to secure necessary budget of the Thai burden shares to implement the Project as immediately as possible after the Grant Aid on the Project is finally agreed between two Governments.

4. The PWD shall take prompt and timely actions to execute the entire works so that the Project can be completed in due accordance with the implementation schedule as shown in the Draft Final Report.

5. The PWD will provide two stock yards at Khon Kaen and Ubon Ratchathani with the areas of at least 6,000 m2 and 4,000 m2 respectively for the supplied materials with the necessary facilities such as;

   1. Security fence.
   2. Shelters to protect supplied materials.
   3. Warehouse for supplied materials.
   4. Temporary house for watchmen.
   5. Utilities such as water supply, electricity and telephone or radio communication.

6. The PWD has agreed to secure proper right of way to provide necessary land area for the construction work and to remove and transfer obstacles such as houses and electricity poles, etc.

7. The PWD,has agreed to get approval of the Thai Government for logging in the construction areas which may be against the law of logging ban taken effect last January.

8. The Final Report (10 copies in English) on the Project will be submitted to the Thai side within May 1989.

APPENDIX 3

- Proposed Bridges
- Selected Bridges

LIST OF PROPOSED BRIDGES

BRIDGE NO.	PROVINCE	NAME OF BRIDGE	ROUTE	LENGTH (M)	GROUP	STAGE
01.01	Kalasin	Huai Kae	B. Kut Kholng -B. Khamin	45.00	II	I
01.02	Kalasin	Lam Nam Pao No. 1	B. Nong Bus -B. Tha Khrai	60.00	II	I
01.04	Kalasin	Huai Si Thon	B. Khok Kwang -B. Kut Khlong	15.00	I	II
02.01	Khon Kaen	Huai Sue Ten	B. Kham Bong -B. Non Dong Man	30.00 (25.00)	I	I
02.02	Khon Kaen	Huai Nong Ben	B. Kham Bong -B. Non Dong Man	25.00 (20.00)	I	I
02.03	Khon Kaen	Huai Yang	B. Kham Bong -B. Non Dong Man	25.00 (20.00)	I	I
02.05	Khon Kaen	Huai Khom Mum	B. Huai Sai -B. Kut Chiang Mee	40.00 (39.00)	I	I
03.01	Chaiya Phum	Huai Khontha	B. Kaeng Khlo -B. Nong Makhua	20.00 (16.50)	I	I
03.02	Chaiya Phum	Nong Phai	B. Kut Lalom -B. Nong Phai	50.00 (46.00)	II	I
03.03	Chaiya Phum	Huai Kut Suang	B. Khok Din Daeng -B. Non Than	36.00 (35.00)	I	II
03.04	Chaiya Phum	Huai Pa Thao	B. Khok Din Daeng -B. Non Than	30.00 (16.00)	I	II
04.01	Nakhon Phanom	Huai Soeng No. 1	B. Phra Song -B. Bo Dok Son	40.00 (35.50)	I	I
04.02	Nakhon Phanom	Huai Soeng No. 2	B. Phra Song -B. Bo Dok Son	40.00 (33.00)	I	I
04.03	Nakhon Phanom	Huai Na Ngua	B. Na. Ngua -B. Un Na	40.00 (25.00)	I	II
04.04	Nakhon Phanom	Huai Na Khoi	B. Na Khoi -B. Un Na	20.00	I	II
04.05	Nakhon Phanom	Huai Na Krathum	B. Na Khoi -B. Un Na	20.00 (9.00)	I	II
04.06	Nakhon Phanom	Huai Nam Un	B. Un Na -B. Un Yang Kham	80.00	II	II