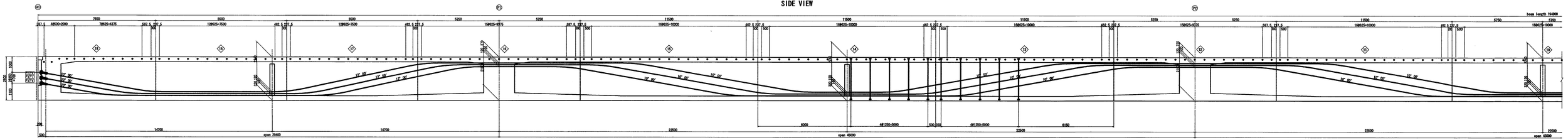
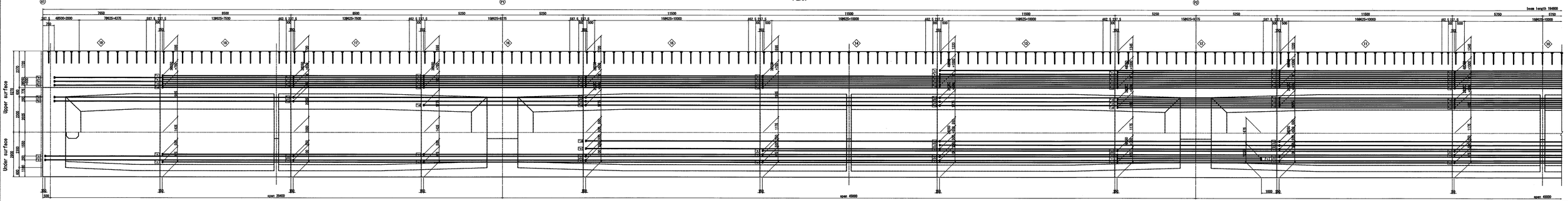
PC CABLE ARRANGEMENT OF GIRDER (1) S=1/50

SIDE VIEW



PLAN

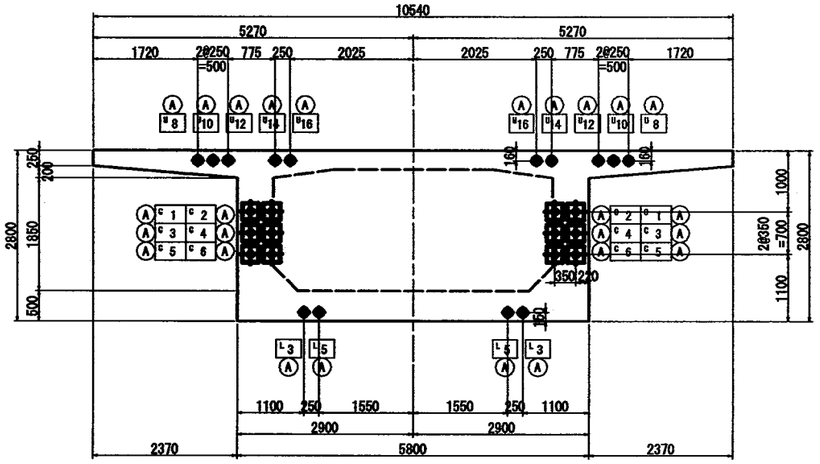


Ministry of Construction, Transport, Post and Communication THE LAO PEOPLE'S DEMOCRATIC REPUBLIC	
BASIC DESIGN STUDY ON THE PROJECT FOR CONSTRUCTION OF NEW KHAMLEP BRIDGE ON NATIONAL ROAD 13	
PC CABLE ARRANGEMENT OF GIRDER (1)	SCALE AS SHOWN
ORIENTAL CONSULTANTS COMPANY LIMITED NIPPON KOEI CO., LTD.	

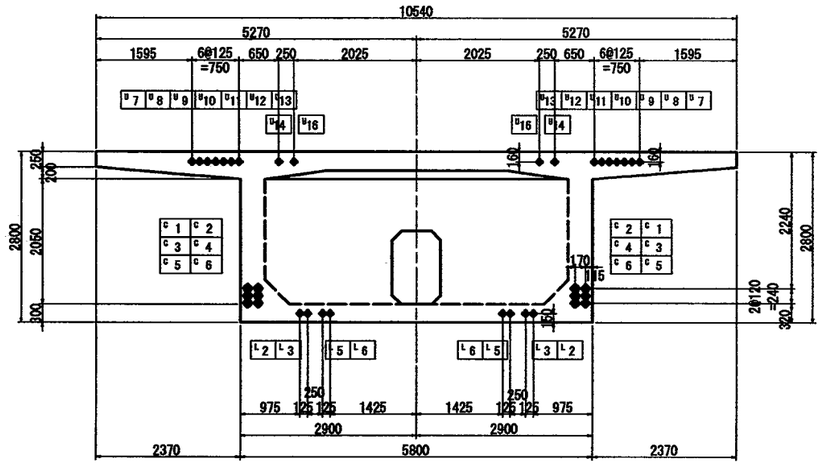
PC CABLE ARRANGEMENT OF GIRDER (3) S=1/50

SECTIONAL VIEW

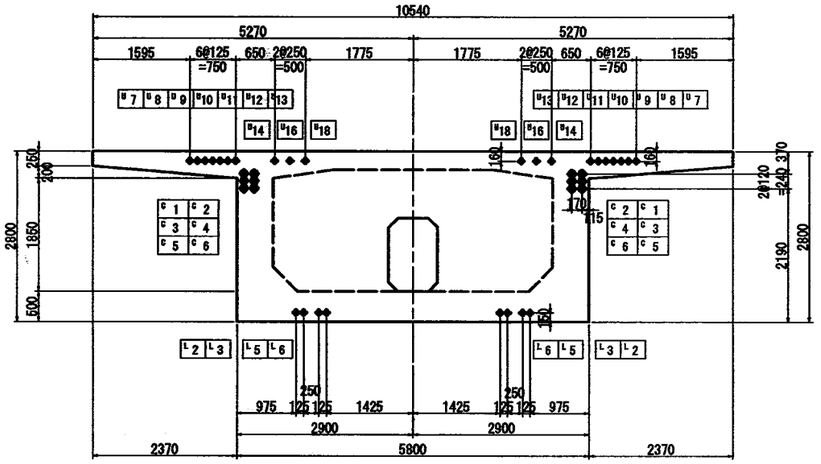
1 - 1



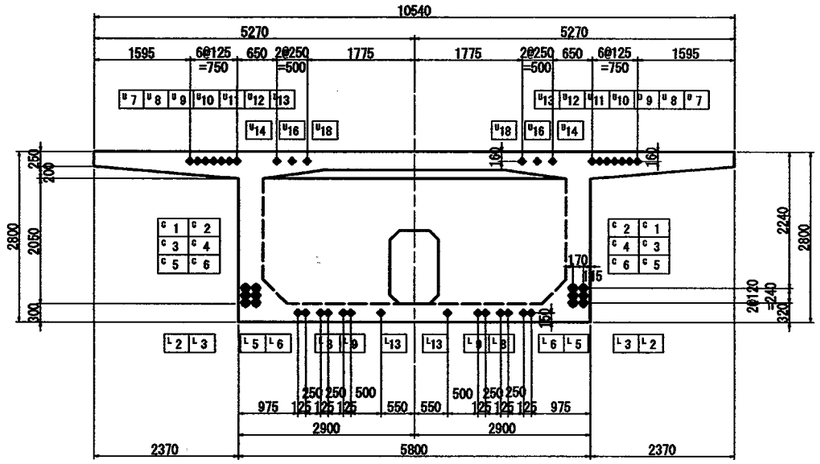
2 - 2



3 - 3



4 - 4

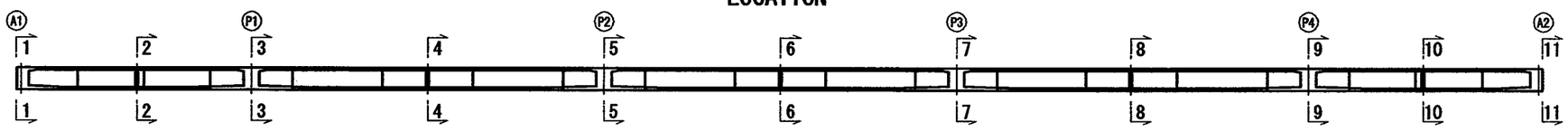


Cable number

Primary cable (φ32)
- (A) Strain end
- (B) Fixed end[side]
- Passage cable

Secondary cable (12S15.2)
- (A) Strain end

LOCATION

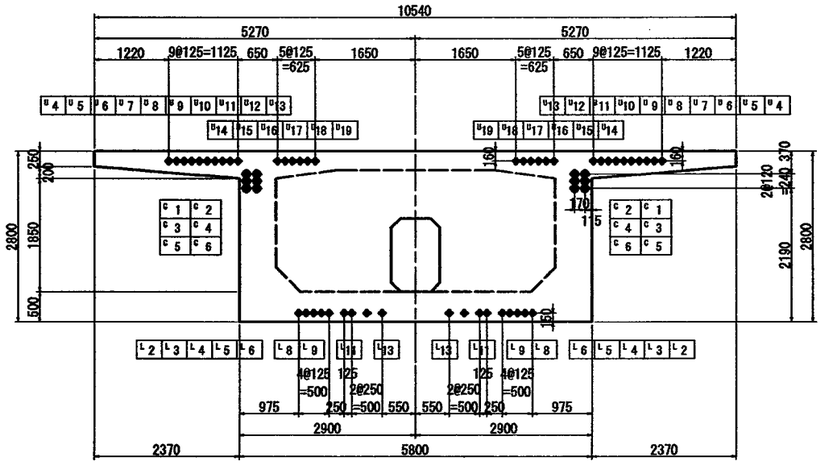


Ministry of Construction, Transport, Post and Communication THE LAO PEOPLE'S DEMOCRATIC REPUBLIC	
BASIC DESIGN STUDY ON THE PROJECT FOR CONSTRUCTION OF NEW HINHEUP BRIDGE ON NATIONAL ROAD 13	
PC CABLE ARRANGEMENT OF GIRDER (3)	SCALE AS SHOWN DRAWING NO.
ORIENTAL CONSULTANTS COMPANY LIMITED NIPPON KOEI CO., LTD.	
DRAWN BY / DESIGNED BY / PROJECT MANAGER / APPROVED BY	

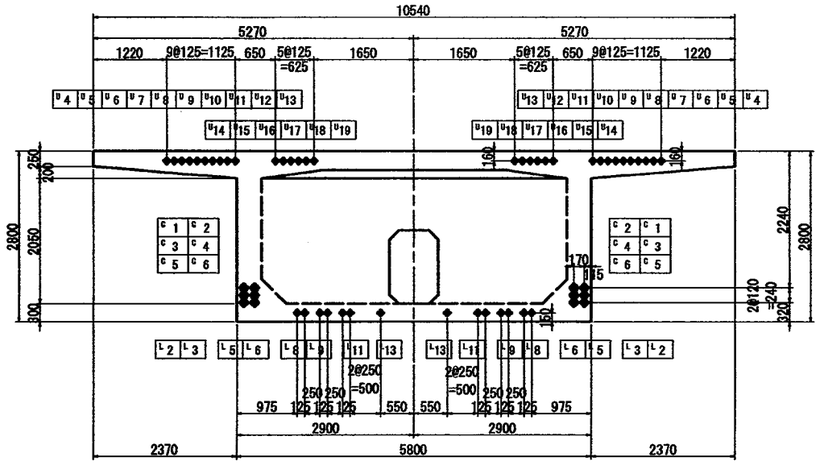
PC CABLE ARRANGEMENT OF GIRDER (4) S=1/50

SECTIONAL VIEW

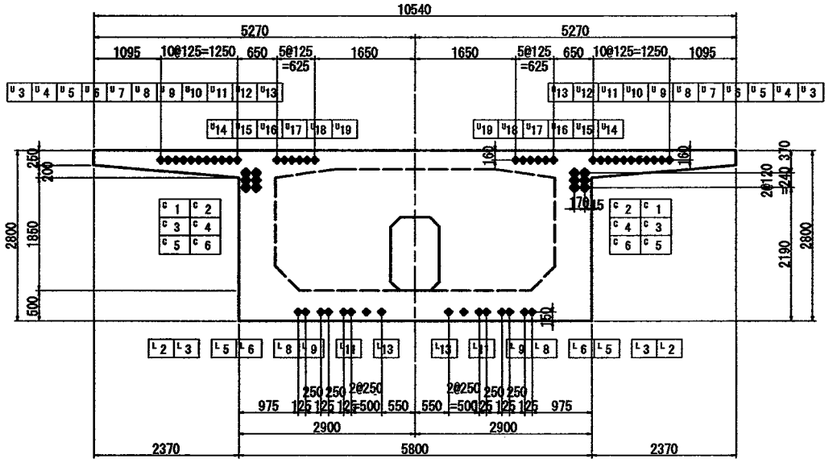
5 - 5



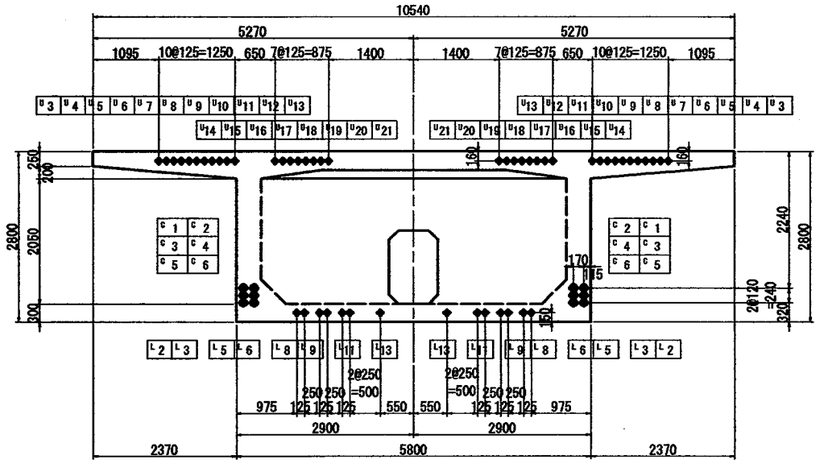
6 - 6



7 - 7



8 - 8



Cable number

Primary cable (ϕ32)

Ⓐ Strain end

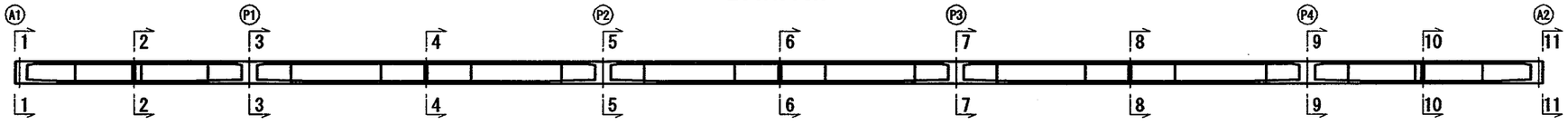
Ⓑ Fixed end[side]

Passage cable

Secondary cable (12S15.2)

Ⓐ Strain end

LOCATION



Ministry of Construction, Transport, Post and Communication THE LAO PEOPLE'S DEMOCRATIC REPUBLIC	
BASIC DESIGN STUDY ON THE PROJECT FOR CONSTRUCTION OF NEW HINHEUP BRIDGE ON NATIONAL ROAD 13	
PC CABLE ARRANGEMENT OF GIRDER (4)	SCALE AS SHOWN
	DRAWING NO.
ORIENTAL CONSULTANTS COMPANY LIMITED NIPPON KOEI CO., LTD.	
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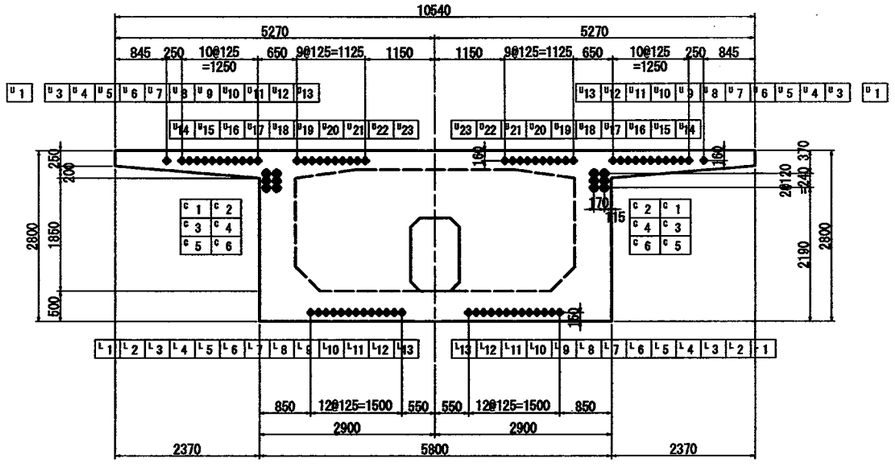
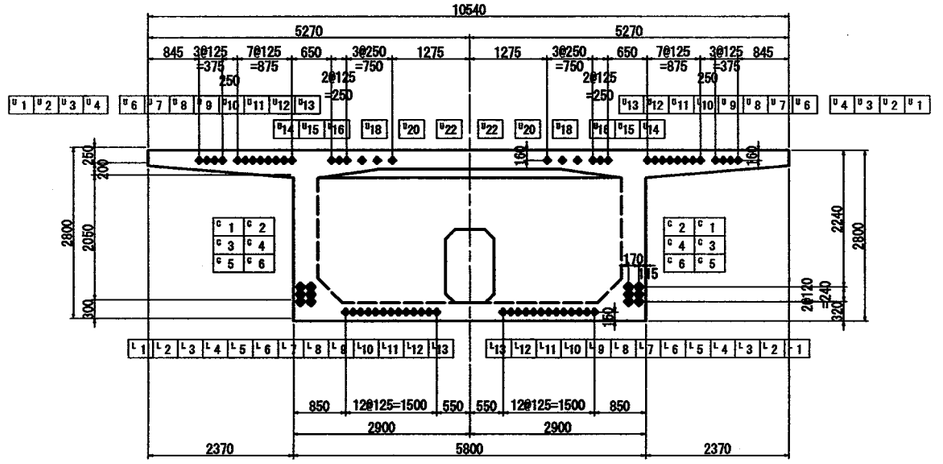
PC CABLE ARRANGEMENT OF GIRDER (5) S=1/50

SECTIONAL VIEW

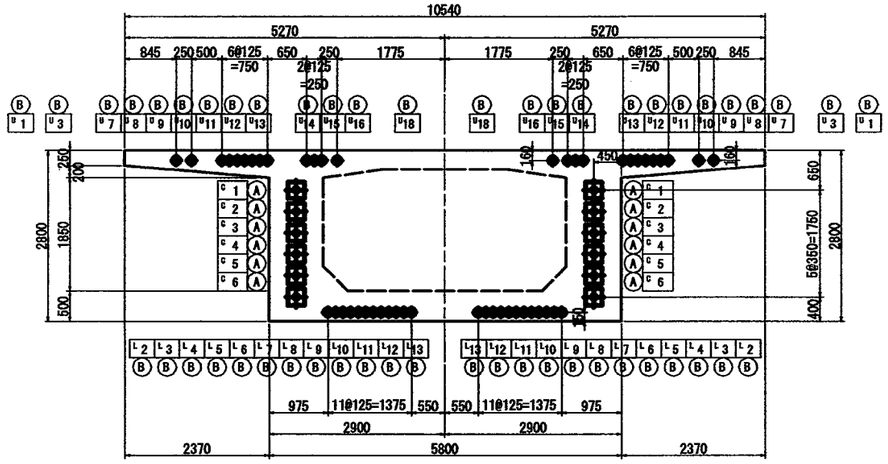
9 - 9



10 - 10



11 - 11

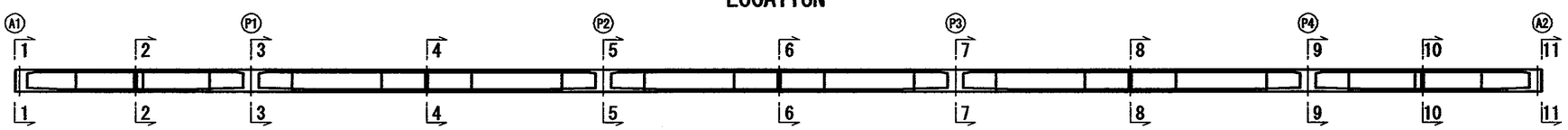


Cable number

Primary cable (φ32)
- (A) Strain end
- (B) Fixed end[side]
- Passage cable

Secondary cable (12S15.2)
- (A) Strain end

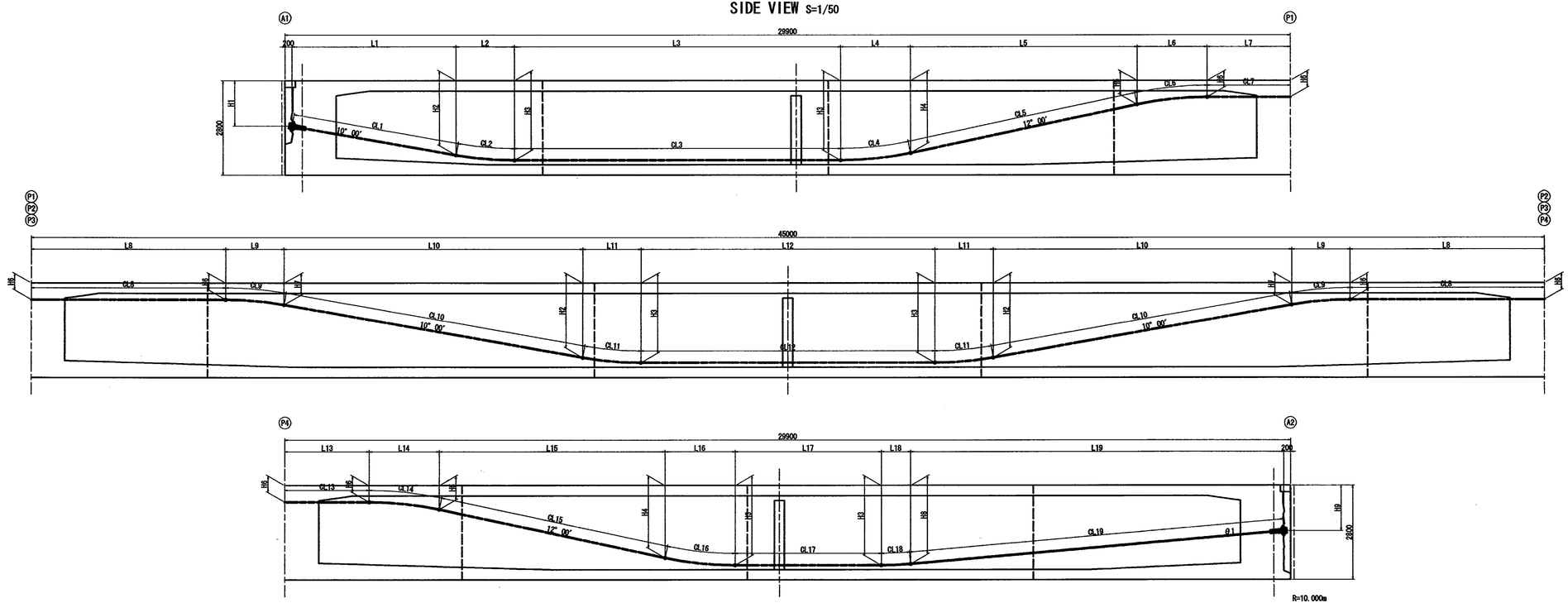
LOCATION



Ministry of Construction, Transport, Post and Communication THE LAO PEOPLE'S DEMOCRATIC REPUBLIC	
BASIC DESIGN STUDY ON THE PROJECT FOR CONSTRUCTION OF NEW HINHEUP BRIDGE ON NATIONAL ROAD 13	
PC CABLE ARRANGEMENT OF GIRDER (5)	SCALE: AS SHOWN DRAWING NO.
ORIENTAL CONSULTANTS COMPANY LIMITED NIPPON KOEI CO., LTD.	
DRAWN BY / DESIGNED BY / PROJECT MANAGER / APPROVED BY	

PC CABLE ARRANGEMENT OF GIRDER (6)

SIDE VIEW S=1/50



Cable number	Number	θ 1	H1	H2	H3	H4	H5	H6	H7	H8	H9	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
C1	2	8° 00'	1000	2088	2240	2021	589	370	522	2143	650	6171	1736	7087	2079	6742	2079	3806	7937	1736	8882	1736	4417	3806	2079	6742
C2	2	6° 30'	1000	2088	2240	2021	589	370	522	2176	1000	6171	1736	7087	2079	6742	2079	3806	7937	1736	8882	1736	4417	3806	2079	6742
C3	2	5° 00'	1350	2208	2360	2141	709	490	642	2322	1350	4866	1736	9709	2079	6742	2079	2489	5782	1736	8882	1736	9727	2489	2079	6742
C4	2	3° 30'	1350	2208	2360	2141	709	490	642	2341	1700	4866	1736	9709	2079	6742	2079	2489	5782	1736	8882	1736	9727	2489	2079	6742
C5	2	2° 00'	1700	2328	2480	2261	829	610	762	2474	2050	3562	1736	12331	2079	6742	2079	1171	3627	1736	8882	1736	13037	1171	2079	6742
C6	2	0° 30'	1700	2328	2480	2261	829	610	762	2480	2400	3562	1736	12331	2079	6742	2079	1171	3627	1736	8882	1736	13037	1171	2079	6742

Cable number	L16	L17	L18	L19	CL1	CL2	CL3	CL4	CL5	CL6	CL7	CL8	CL9	CL10	CL11	CL12	CL13	CL14	CL15	CL16	CL17	CL18	CL19	ΣL
C1	2079	2982	1392	10621	6266	1745	7087	2094	6892	2094	3806	7937	1745	9019	1745	4417	3806	2094	6892	2094	2982	1396	10725	195904
C2	2079	3544	1132	10319	6266	1745	7087	2094	6892	2094	3806	7937	1745	9019	1745	4417	3806	2094	6892	2094	3544	1134	10386	195864
C3	2079	4331	872	11109	4941	1745	9709	2094	6892	2094	2489	5782	1745	9019	1745	8727	2489	2094	6892	2094	4331	873	11152	195818
C4	2079	5216	610	10486	4941	1745	9709	2094	6892	2094	2489	5782	1745	9019	1745	8727	2489	2094	6892	2094	5216	611	10506	195795
C5	2079	5141	349	12139	3617	1745	12331	2094	6892	2094	1171	3627	1745	9019	1745	13037	1171	2094	6892	2094	5141	349	12147	195762
C6	2079	8419	87	9123	3617	1745	12331	2094	6892	2094	1171	3627	1745	9019	1745	13037	1171	2094	6892	2094	8419	87	9124	195755

PC cable 12S15.2 (SWPR7BL)

Cable number	Length (m)	Number	Weight (kg/m)	Weight (kg/one)	Weight (kg)
C1	195.904	2	13.212	2588.284	5177
C2	195.864	2	13.212	2587.755	5176
C3	195.818	2	13.212	2587.147	5174
C4	195.795	2	13.212	2586.844	5174
C5	195.762	2	13.212	2586.408	5173
C6	195.755	2	13.212	2586.315	5173
			All Weight	Σn=12	ΣW=31047

Ministry of Construction, Transport, Post and Communication
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

BASIC DESIGN STUDY ON THE PROJECT FOR CONSTRUCTION OF NEW HINHEUP BRIDGE ON NATIONAL ROAD 13

PC CABLE ARRANGEMENT OF GIRDER (6)

SCALE AS SHOWN

DRAWING NO.

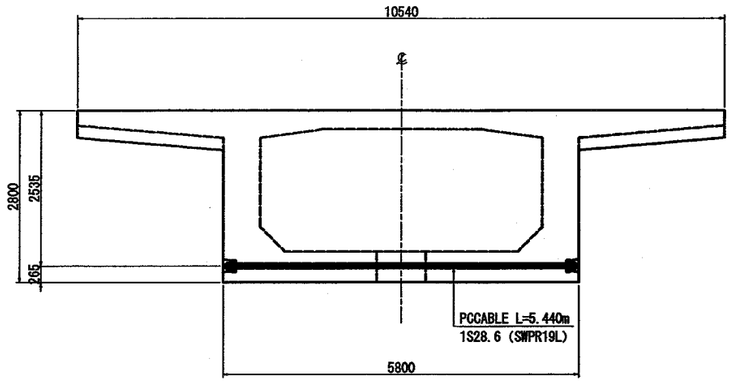
ORIENTAL CONSULTANTS COMPANY LIMITED
NIPPON KOEI CO., LTD.

DRAWN BY	DESIGNED BY	PROJECT MANAGER	APPROVED BY

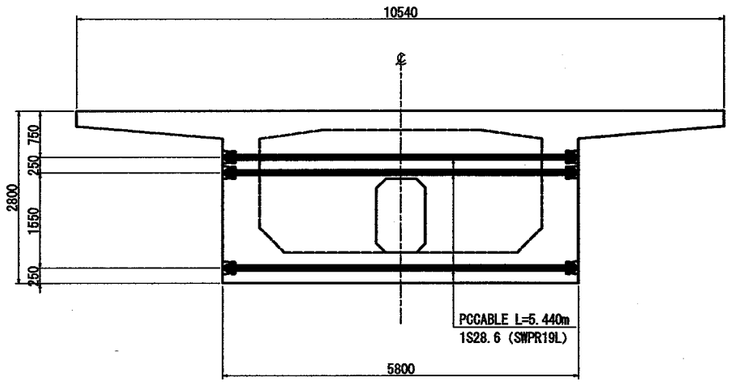
PC CABLE ARRANGEMENT OF CROSS BEAM

SECTIONAL VIEW S=1/50

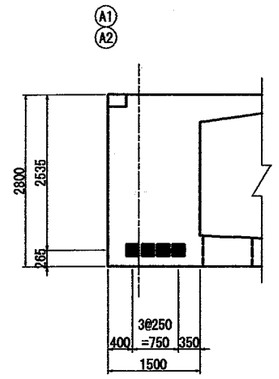
End fulcrum part section

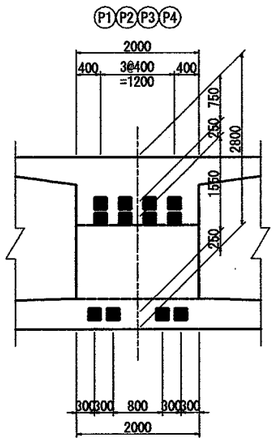


Middle fulcrum part section

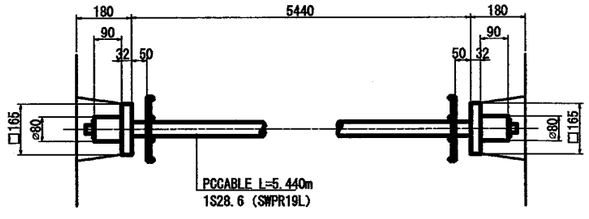


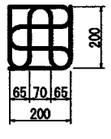
SIDE VIEW S=1/50





DETAIL OF ANCHORAGE S=1/10





2-φ10x914

PC cable 1S28.6 (SWPR19L)

Length (m)	Number	Weight (kg/m)	Weight (kg/one)	Weight (kg)
5.440	56	4.229	23.006	1288
		All Weight	Σn=56	ΣW=1288

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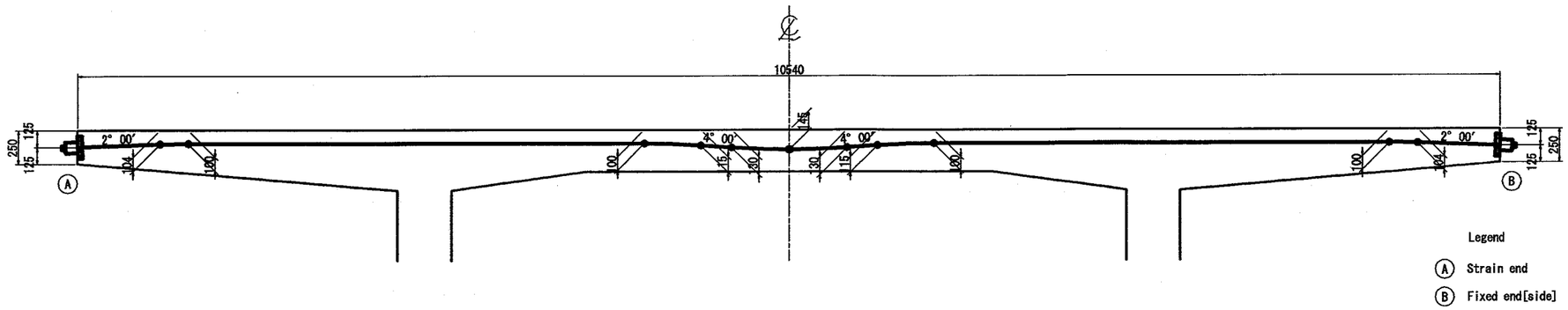
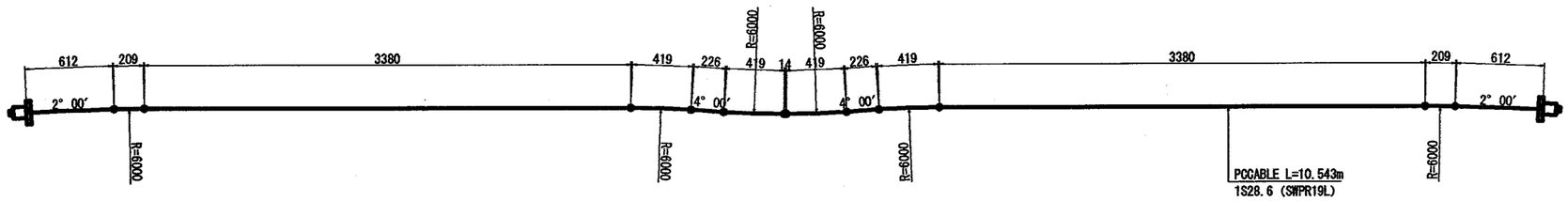
PC CABLE ARRANGEMENT OF CROSS BEAM	SCALE: AS SHOWN DRAWING NO.
ORIENTAL CONSULTANTS COMPANY LIMITED NIPPON KOEI CO., LTD.	
DRAWN BY / DESIGNED BY / PROJECT MANAGER / APPROVED BY	

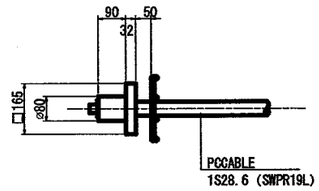
PC CABLE ARRANGEMENT OF SLAB

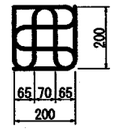
SECTIONAL VIEW S=1/20





DETAIL OF ANCHORAGE S=1/10





2-φ10x914

PC cable 1S28.6 (SWPR19L)

Length (m)	Number	Weight (kg/m)	Weight (kg/one)	Weight (kg)
10.543	322	4.229	44.586	14357
		All Weight	Σn=322	ΣW=14357

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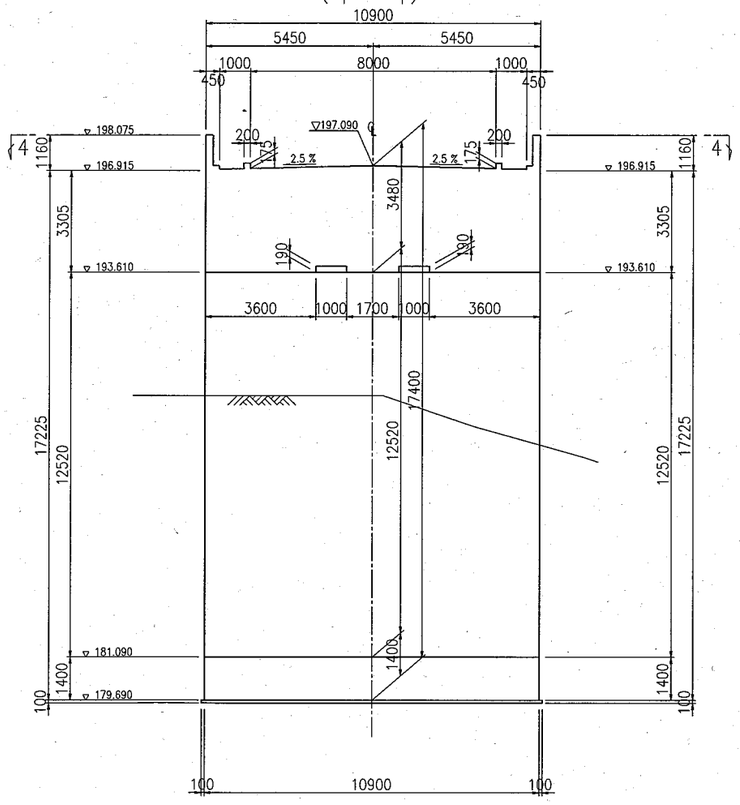
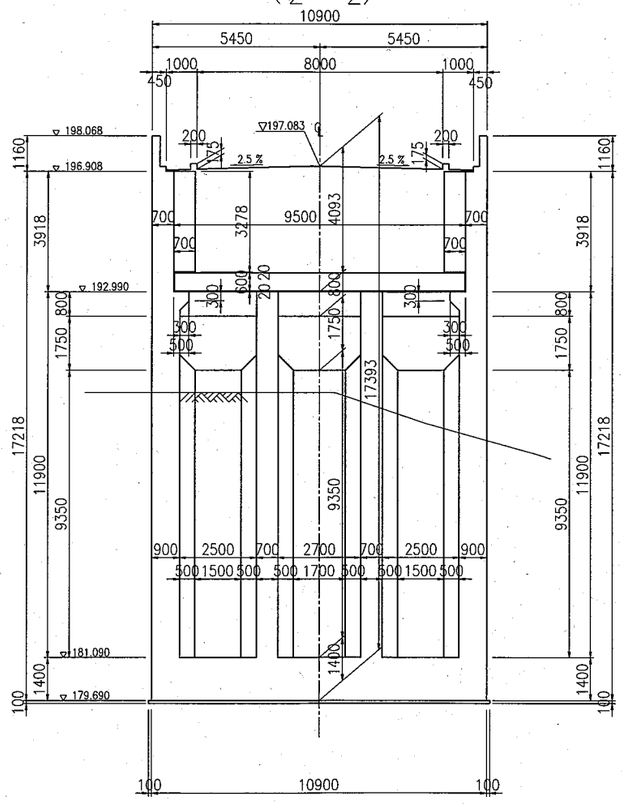
PC CABLE ARRANGEMENT OF SLAB	SCALE: AS SHOWN DRAWING NO.
ORIENTAL CONSULTANTS COMPANY LIMITED NIPPON KOEI CO., LTD.	
DRAWN BY / DESIGNED BY / PROJECT MANAGER / APPROVED BY	

GENERAL STRUCTURAL DRAWING (A1) S = 1 / 100
(1/2)

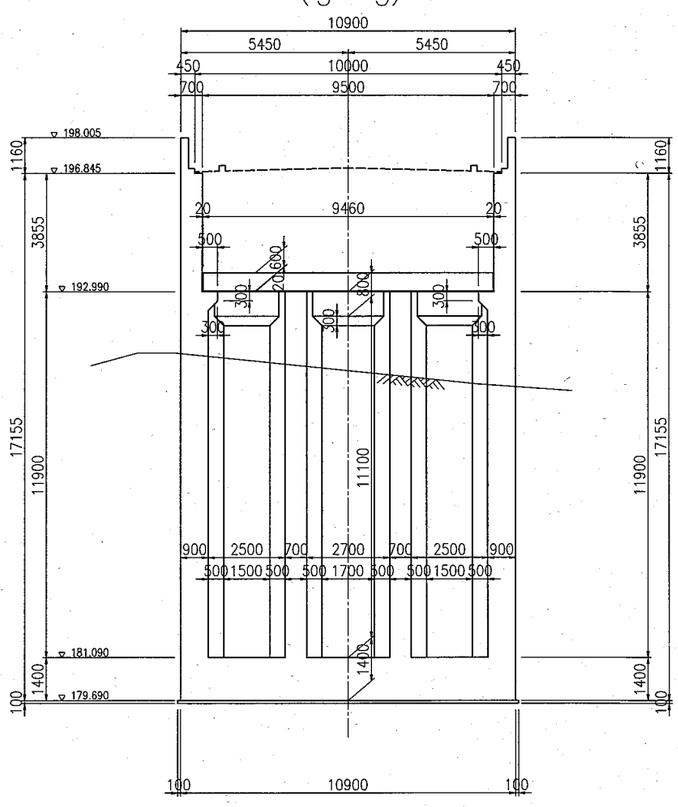
FRONT VIEW
(1 – 1)



REAR VIEW
(2 – 2)



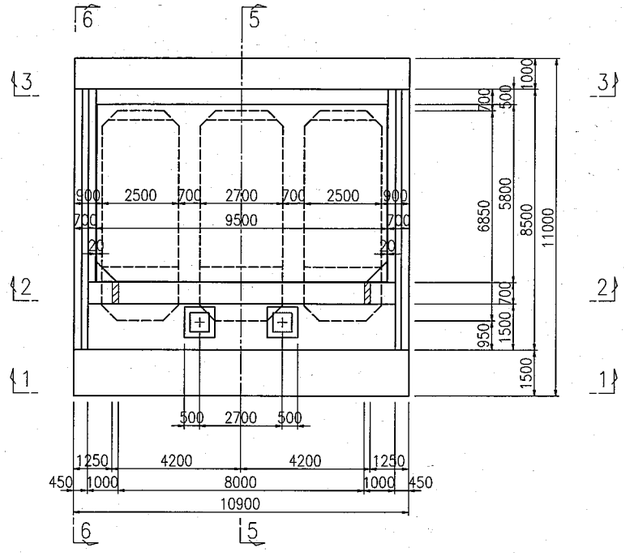
SECTION
(3 – 3)



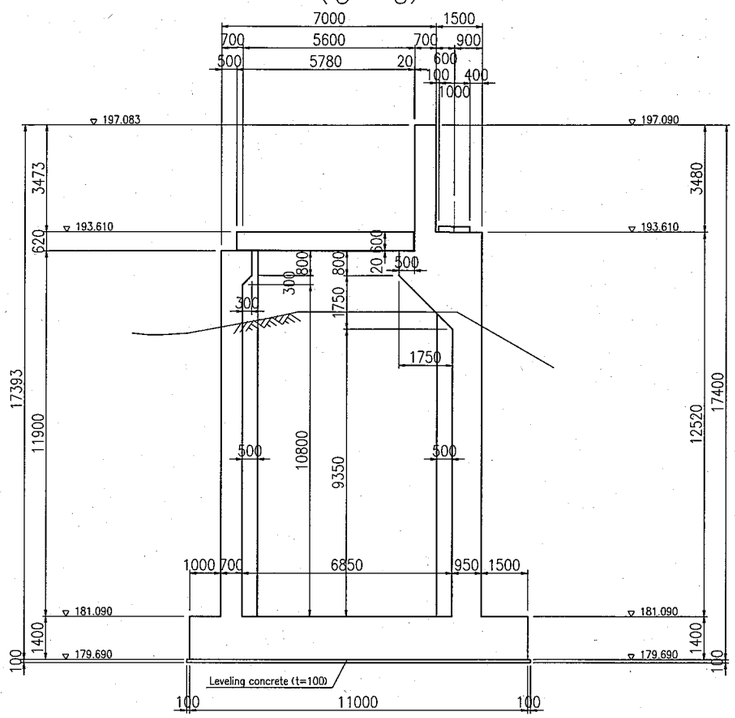
LAO PEOPLE'S DEMOCRATIC REPABLIC MINISTRY OF COMMUNICATION, TRANSPORT, POST & CONSTRUCTION		
The Project for Construction of the Hinheup Bridge on National Road 13		
GENERAL STRUCTURAL DRAWING (A1) (1/2)		Scale Drawing NO.
Oriental Consultants Co., Ltd In association with Nippon Koei Co., Ltd		
Drawn by	Checked by	Approved by

GENERAL STRUCTURAL DRAWING (A1) S = 1 / 100
(2/2)

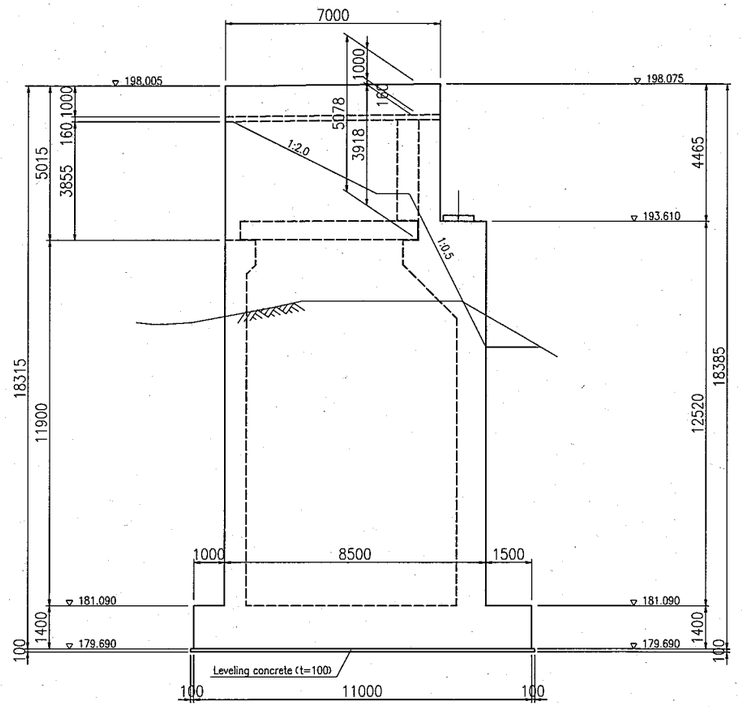
PLAN
(4 – 4)



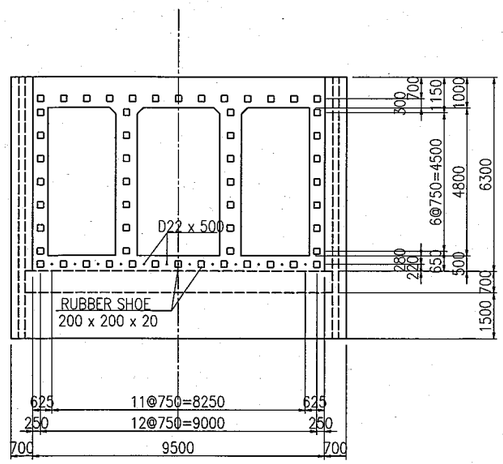
SECTION
(5 – 5)



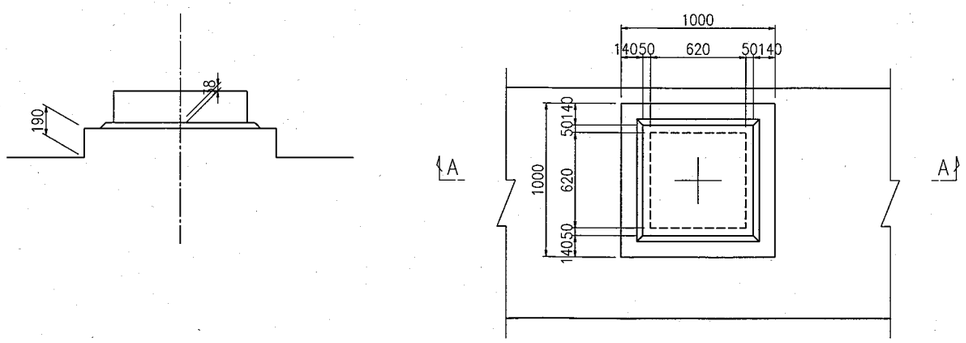
SIDE VIEW
(6 – 6)



PLAN OF SHOE



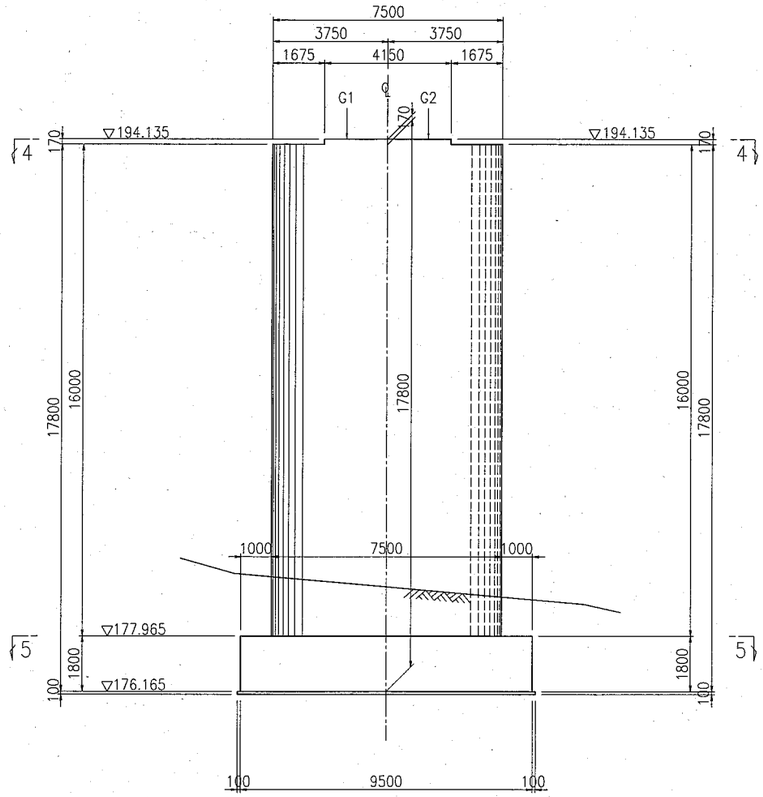
SHOE DETAILS
(A – A) S = 1 / 20



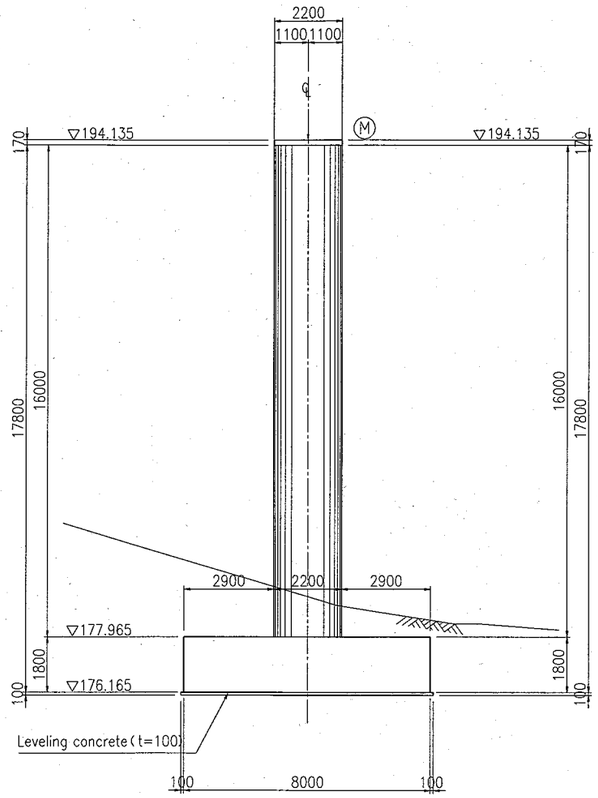
LAO PEOPLE'S DEMOCRATIC REPABLIC MINISTRY OF COMMUNICATION, TRANSPORT, POST & CONSTRUCTION		
The Project for Construction of the Hinheup Bridge on National Road 13		
GENERAL STRUCTURAL DRAWING (A1) (2/2)		Scale Drawing NO.
Oriental Consultants Co., Ltd In association with Nippon Koei Co., Ltd		
Drawn by	Checked by	Approved by

GENERAL STRUCTURAL DRAWING (P1) S = 1 / 100

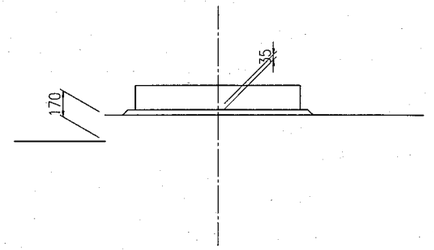
FRONT VIEW
(1 – 1) (2 – 2)

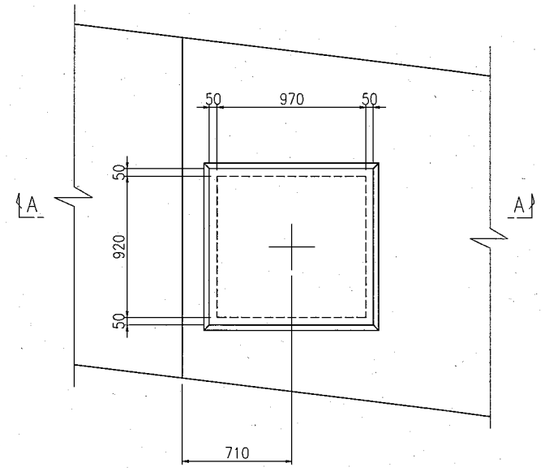


SIDE VIEW (P1)
(3 – 3)



SHOE DETAILS
(A – A)





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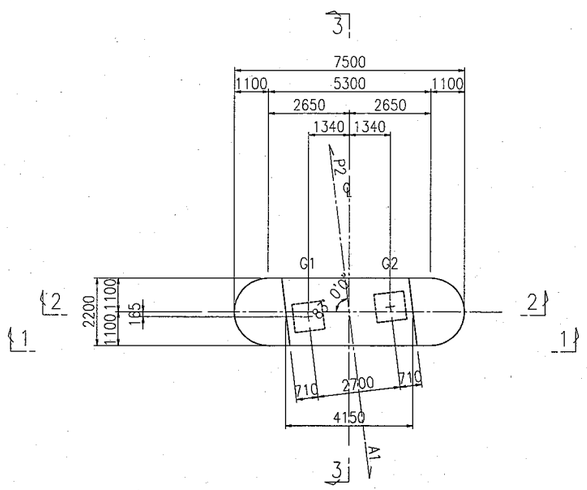

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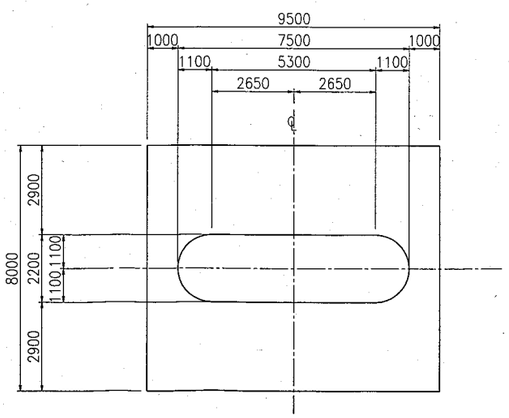

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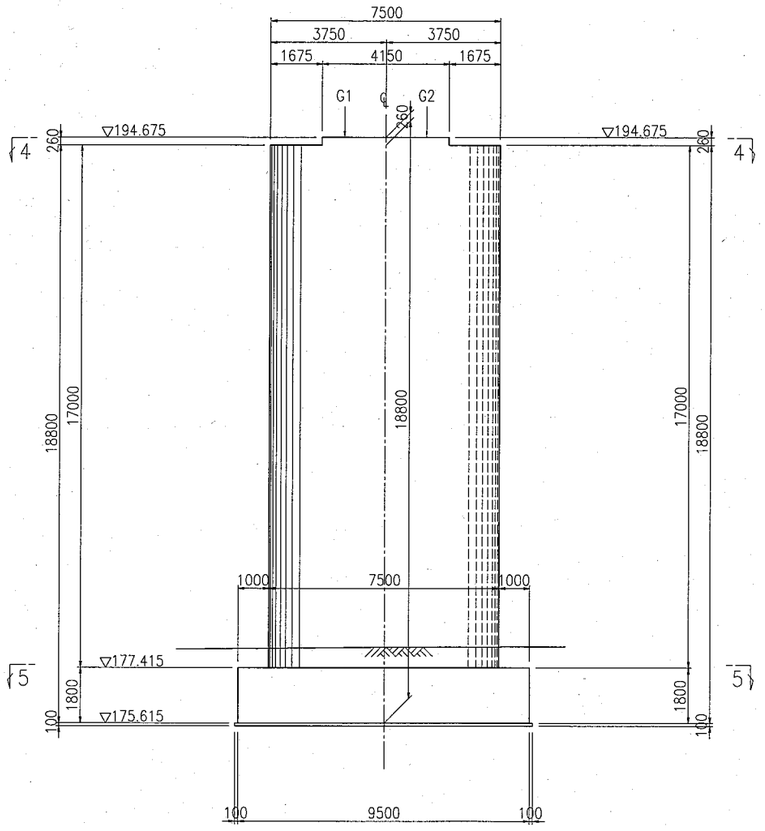

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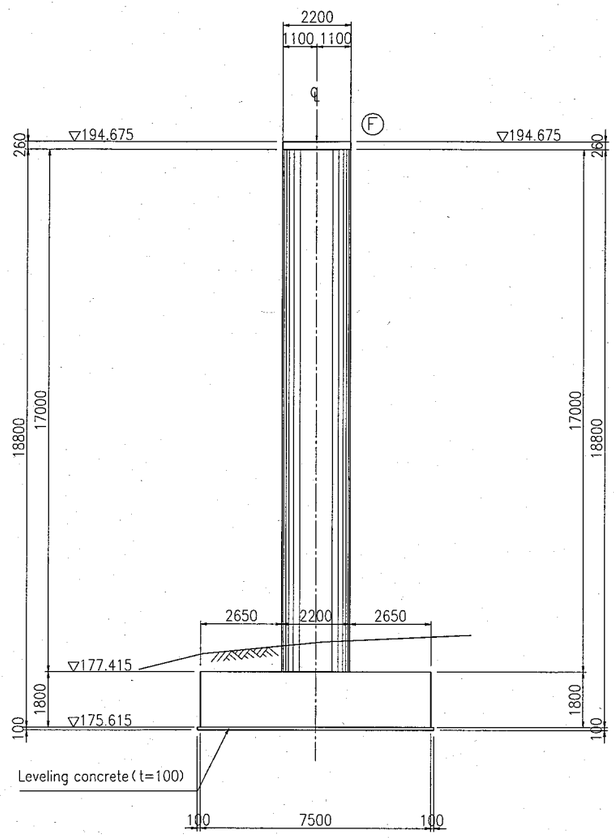

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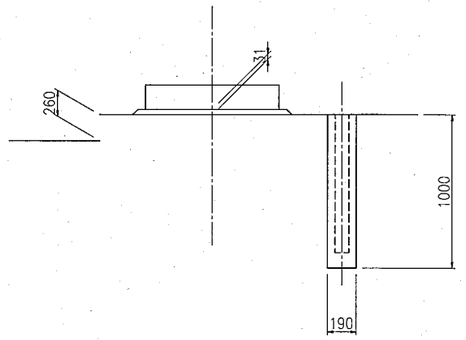

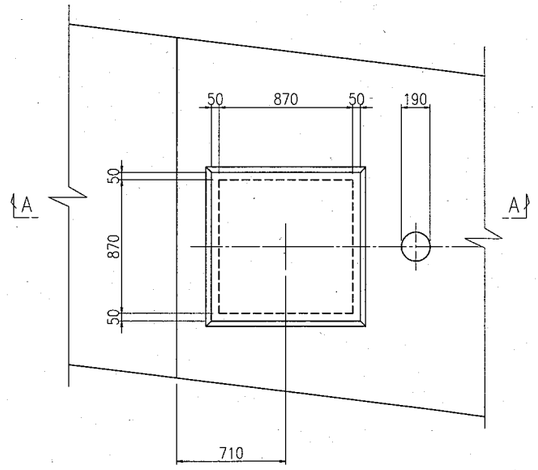

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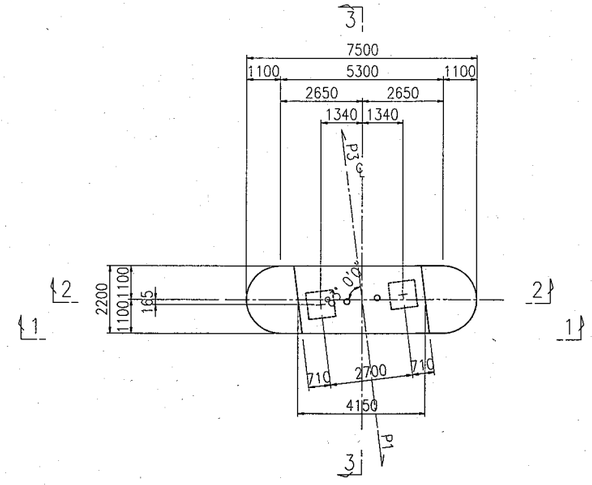

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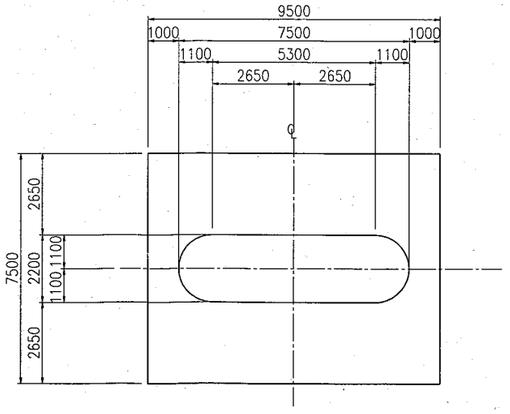

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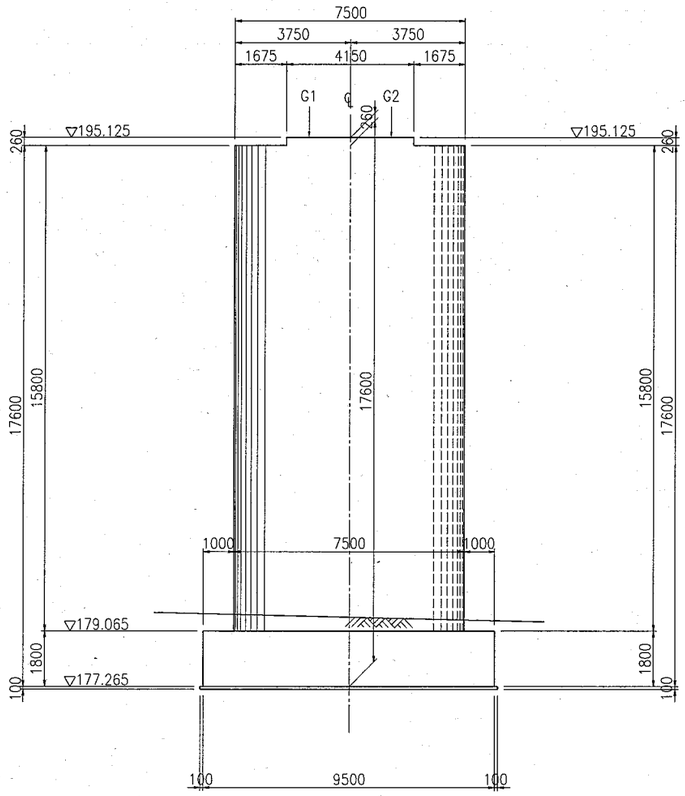

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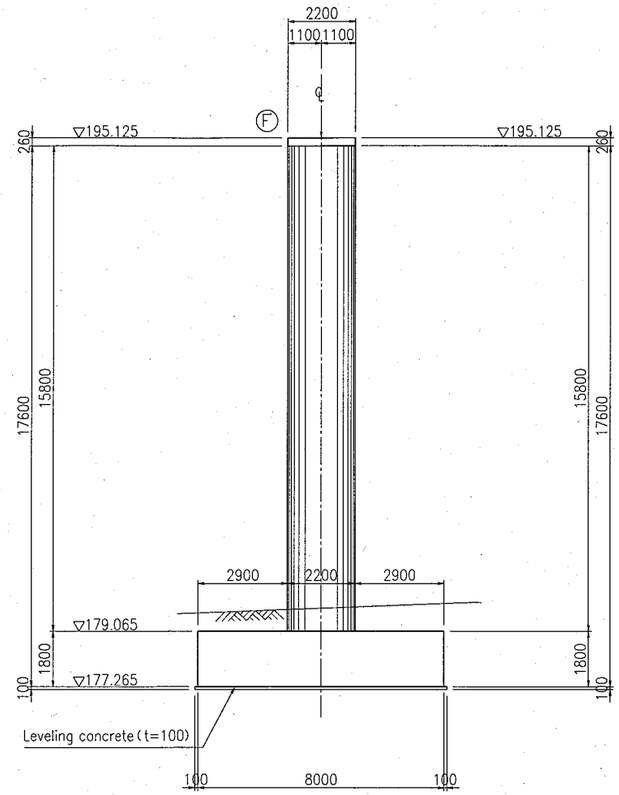

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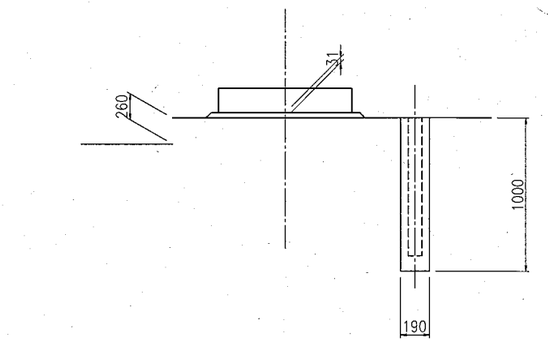

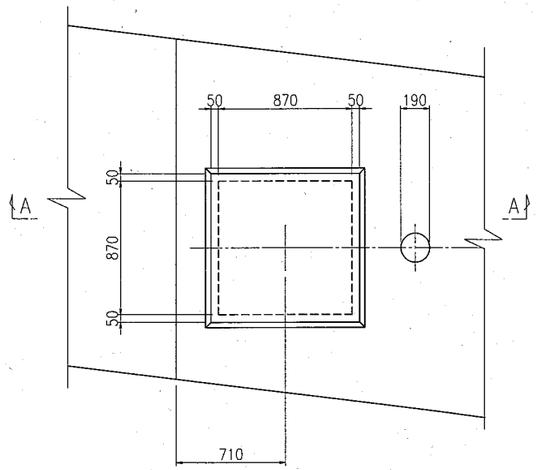

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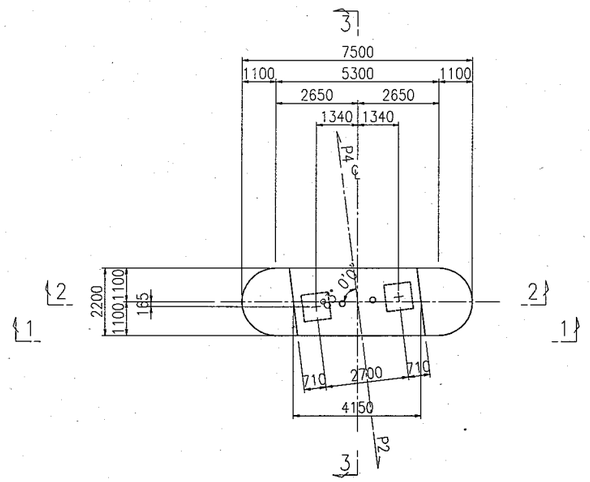

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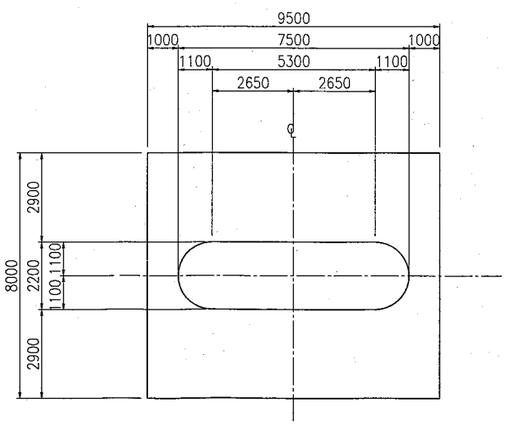

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The Project for Construction of the Hinheup Bridge on National Road 13		
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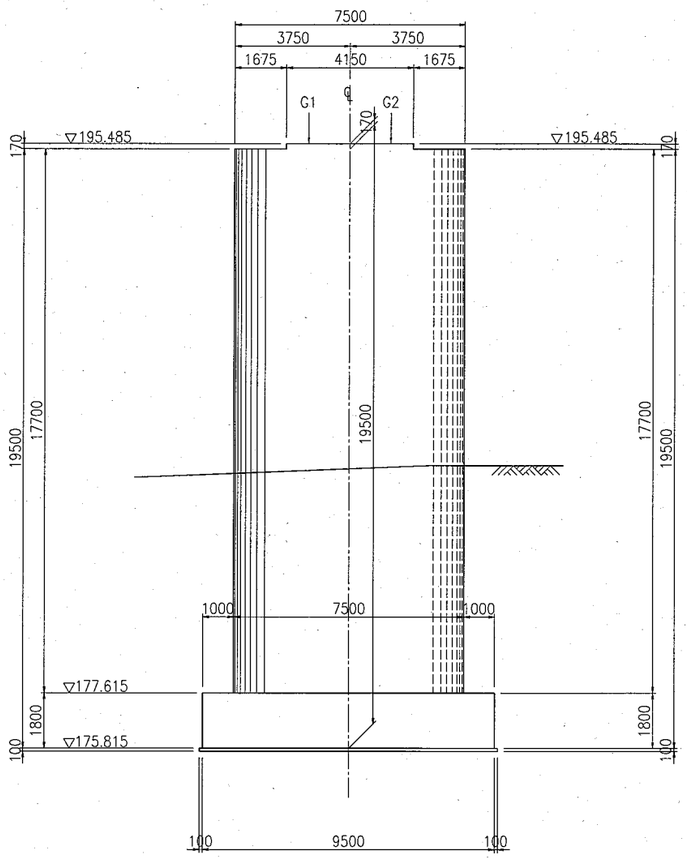

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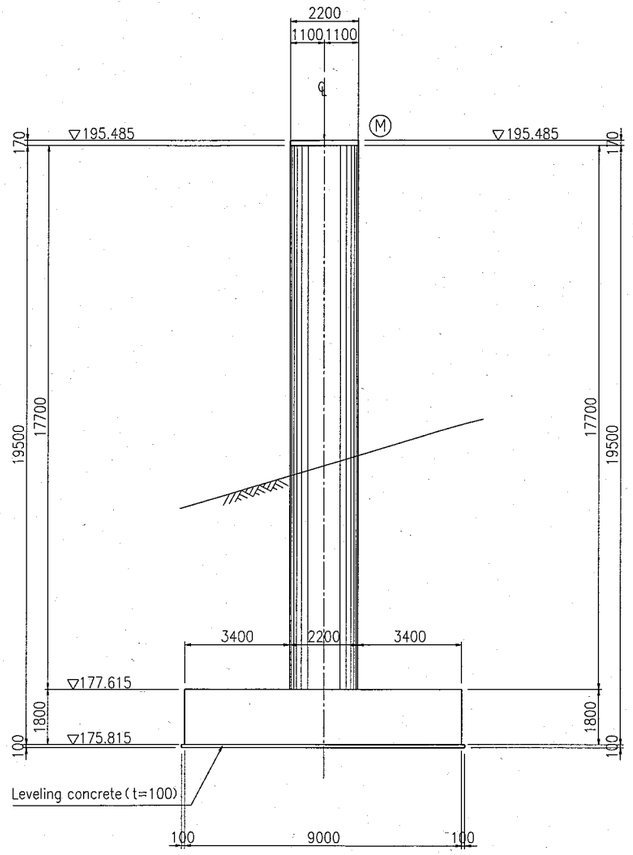

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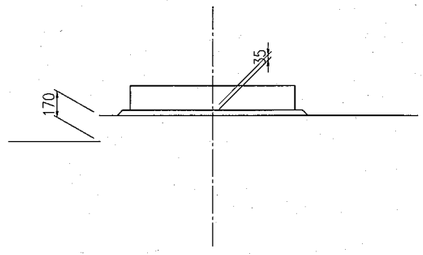

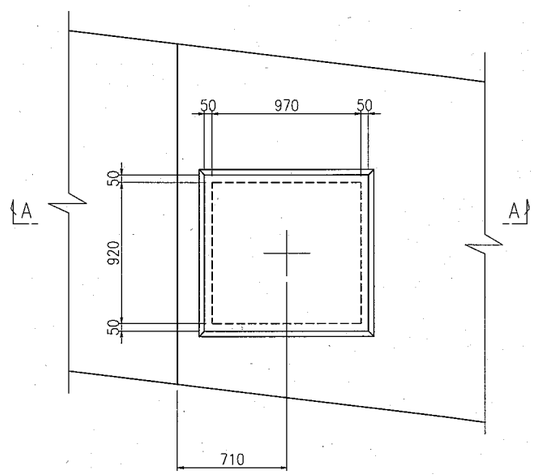

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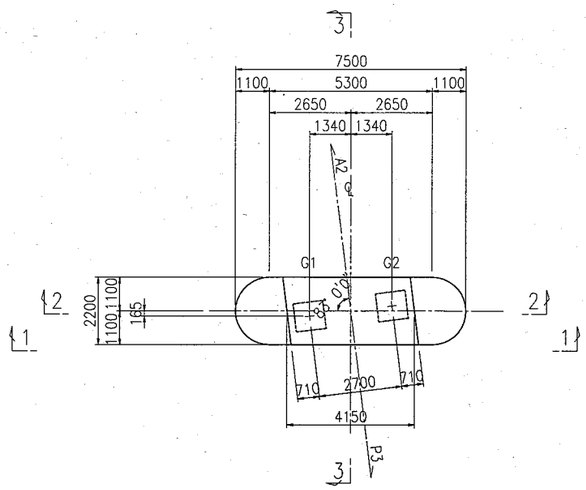

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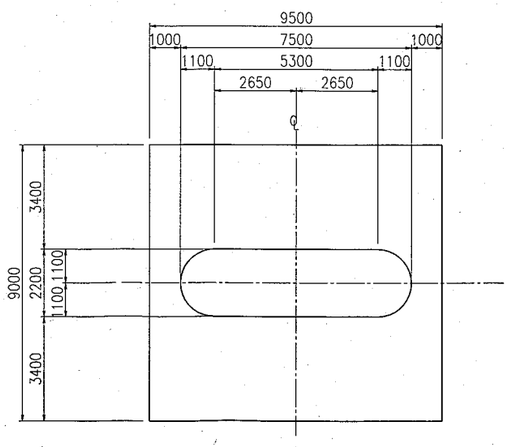

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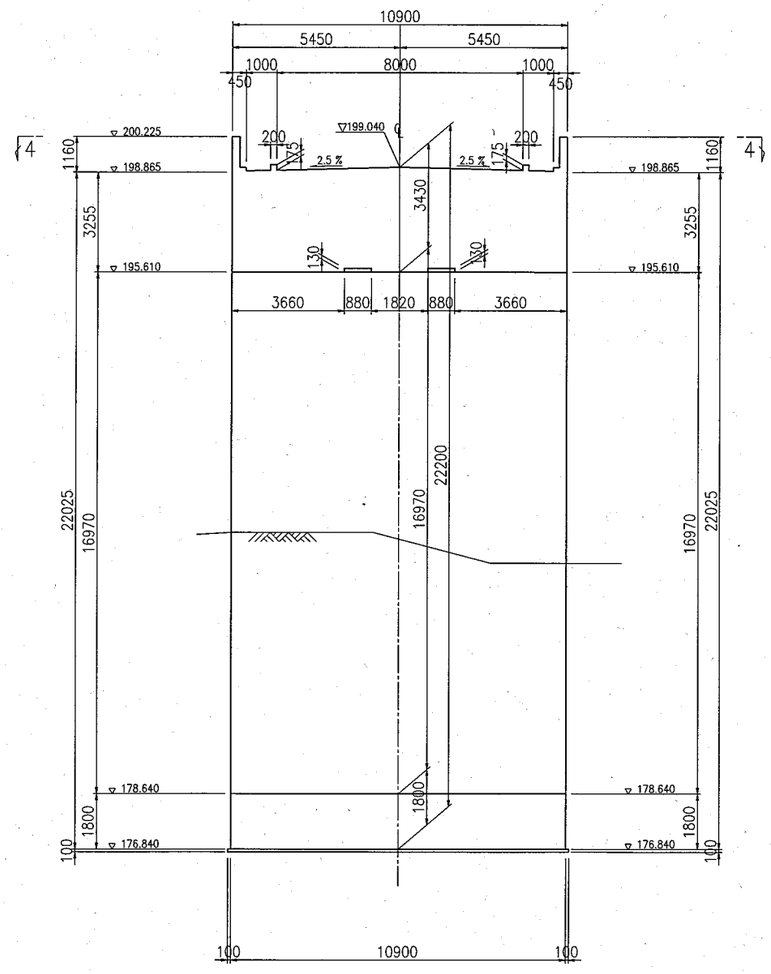

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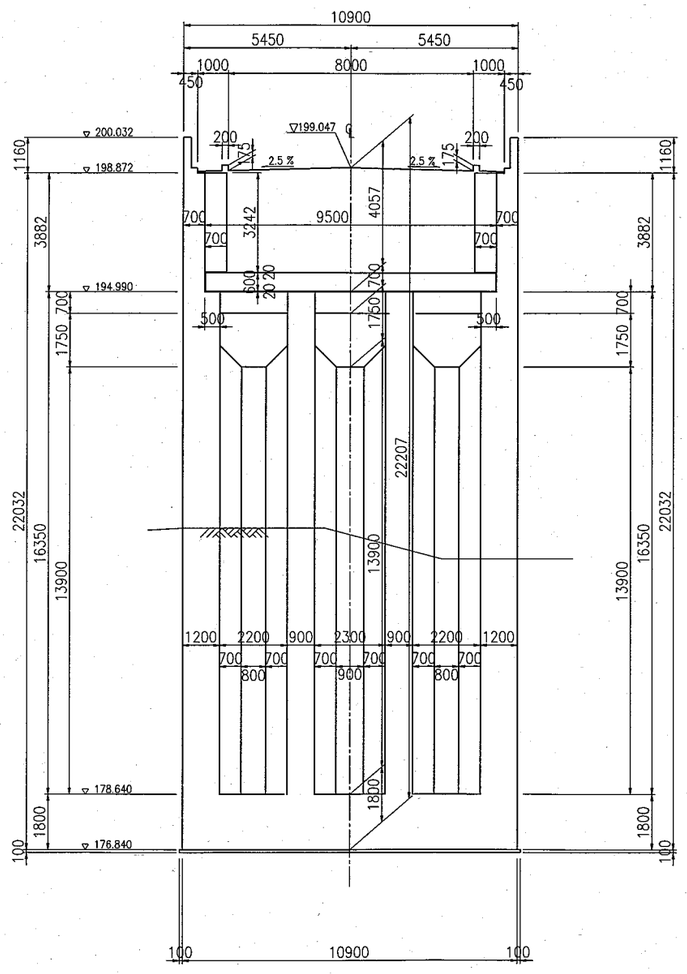

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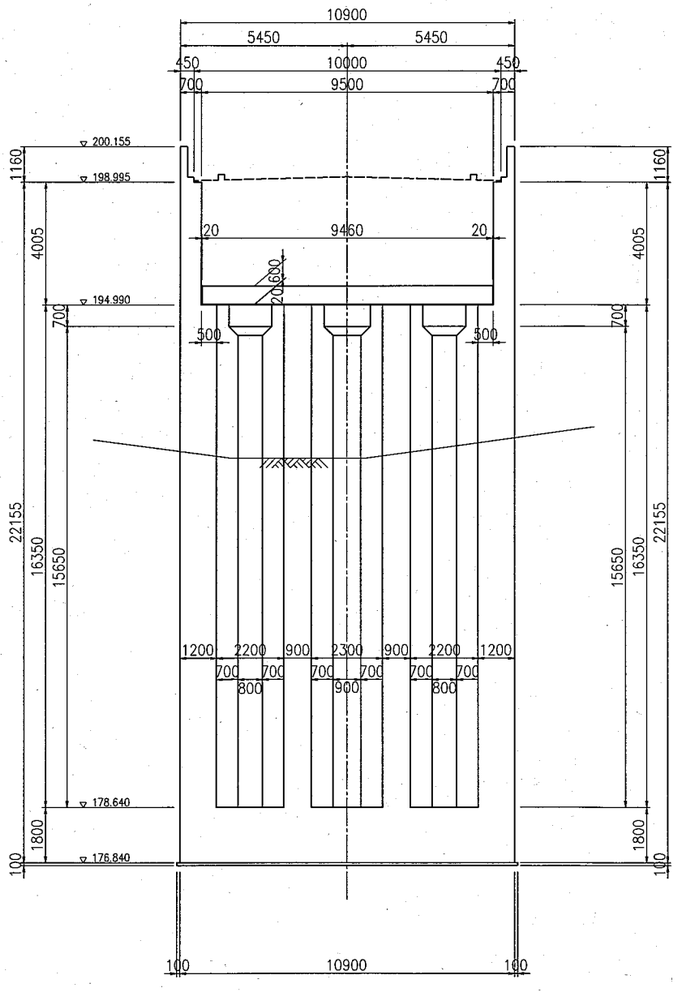

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Drawn by	Checked by	Approved by

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PLAN
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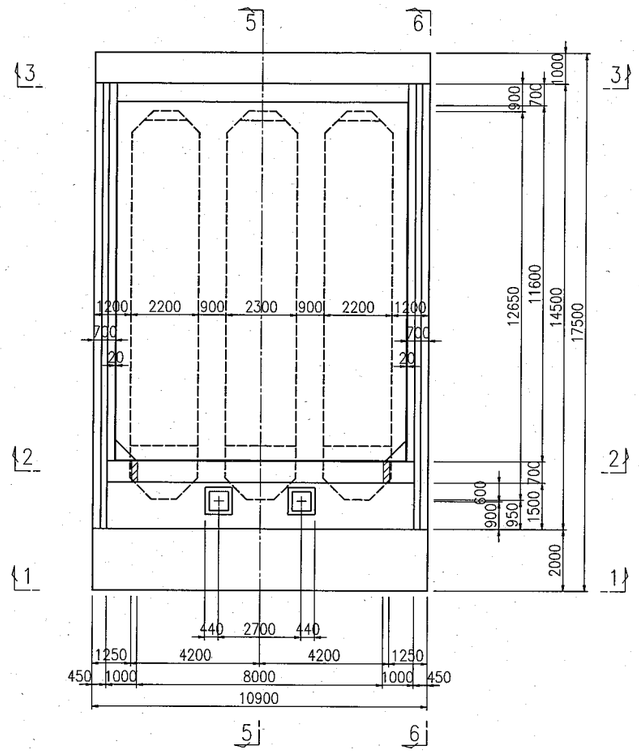

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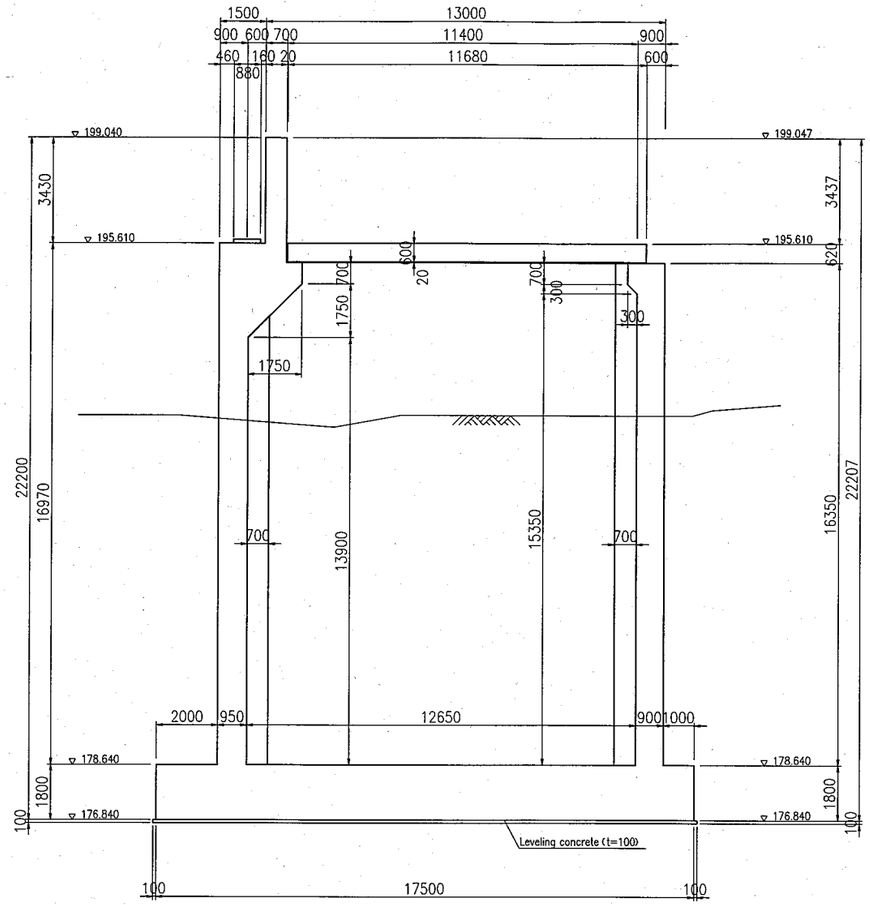

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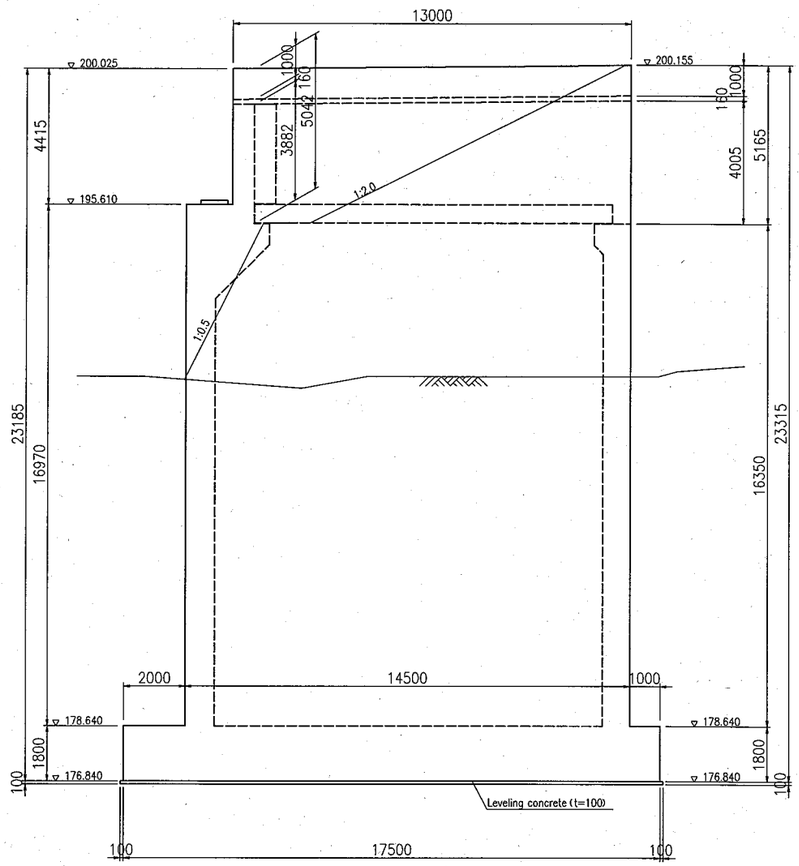
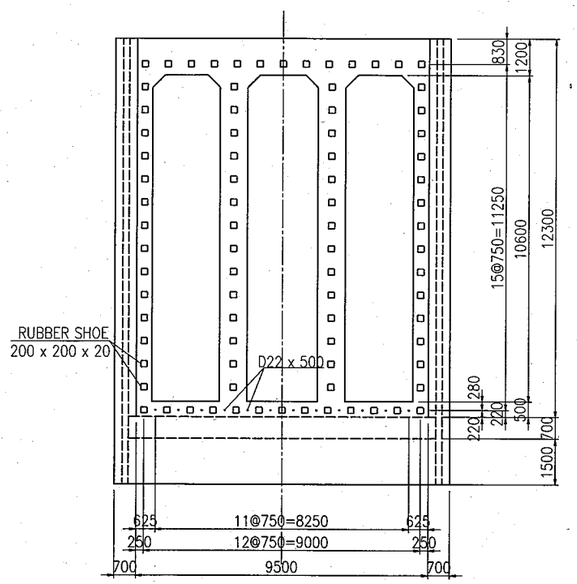


PLAN OF SHOE



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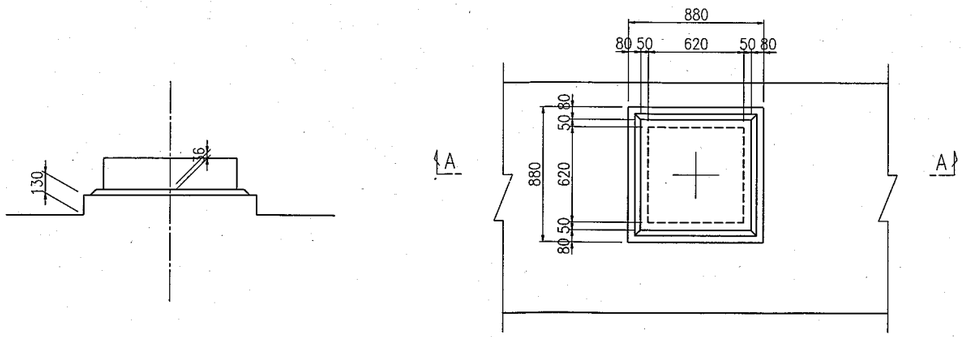

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2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

(1) Basic Concept

The Project is to construct a new Hinheup Bridge, which is the last temporary bridge on NR13N, and is to be implemented by a Japanese contractor under the Japan's Grant Aid scheme. In consideration of this, the following describes the basic implementation concept for the Project:

- The DOR of MCTPC will implement the Project from the tendering stage throughout the construction stage. However, the operation and maintenance of all the proposed facilities will be transferred to the DCTPC of Vientiane Province. Accordingly, close communication between the DOR and DCTPC will be required for Project implementation.
- The utilization of local resources including manpower, materials and equipment should be maximized to contribute to technical transfer and creation of employment opportunities for local people.
- There are two seasons: a rainy season from May to October and a dry season from November to April. The Nam Lik River, which the proposed bridge is to cross, is affected by the rainy season. Accordingly, it is necessary to consider the effects of climate in the construction planning.
- Local engineers and staff should be employed as much as possible. However, Japanese technicians for superstructure erection work, including the foreman, skilled technician for PC tensioning, and electrician, will be sent for the necessary period of time, as this is the first time for the incremental launching method for erecting superstructure to be used in Lao PDR.
- The incremental launching method will be adopted for superstructure erection. The construction yard for erection work will be on the right bank (Vientiane Municipality side), and girders will be launched in the direction of the right bank. Erection work will continue during the rainy season, as girder fabrication will be carried out under a roof to be installed.
- Substructure work will be basically conducted only in the dry season. Temporary soil retaining work with sheet piles is to be provided for abutment excavation due to its depth. For pier excavation, artificial islands will be provided around the piers to cope with high water levels in the rainy season.
- Safety for both pedestrians and vehicles should be given high priority during construction, and negative impacts on both natural and social environment should be minimized.

(2) Construction Schedule

It is assumed that construction work will commence in September 2007 and be completed in November 2009 (a total of 27 months).

(3) Construction Methods

1) Overall Work Flow

The overall work flow is as shown in Figure 2.2.4.1.

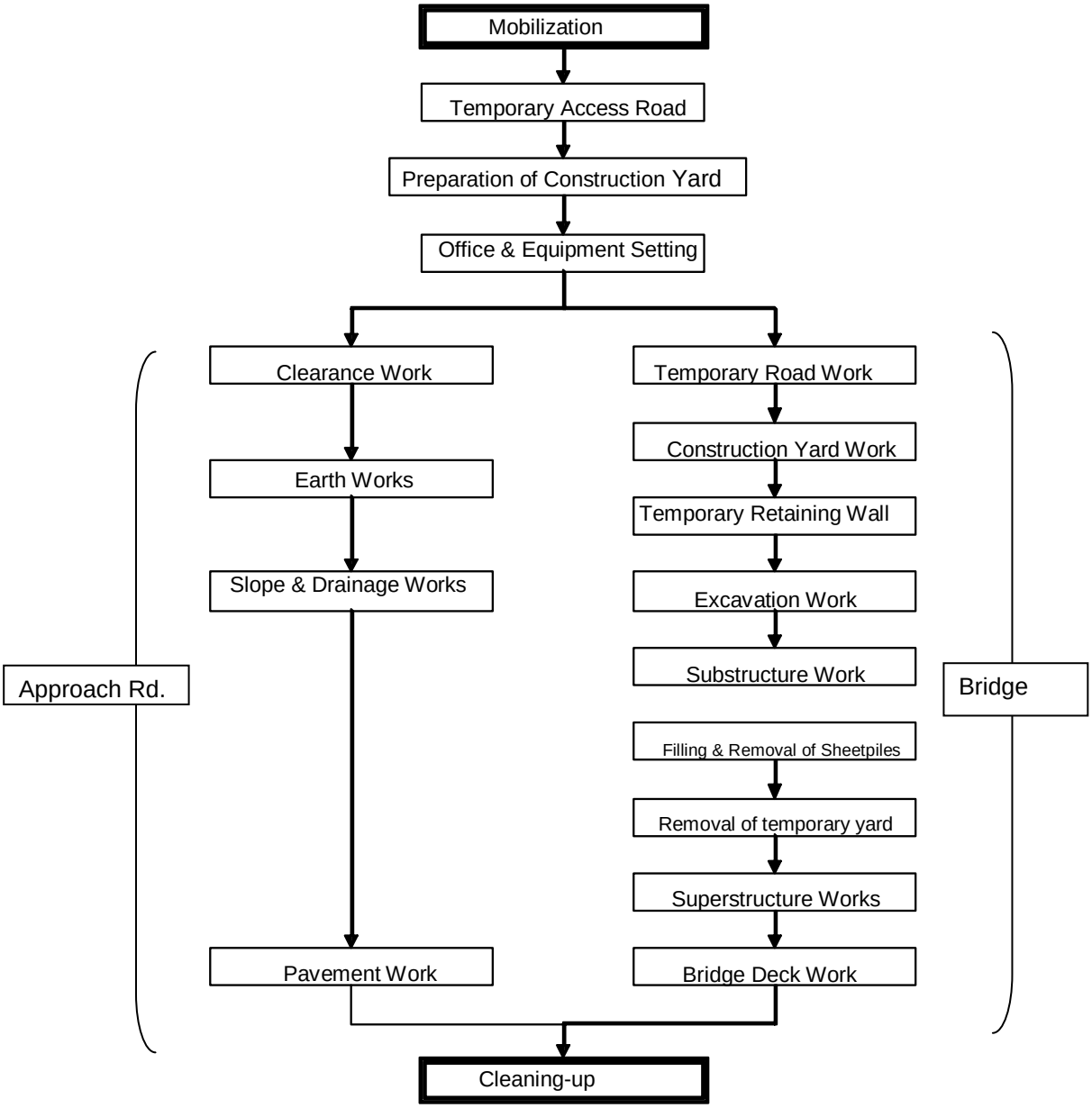

Figure 2.2.12 Work Flow of Construction Stage

2) Description of Each Work

① Provision of Temporary Access Road for Construction

A temporary access road to the construction site will be provided from the existing NR13N by improving the existing road. This temporary road will be paved with gravel and widened to 6m so heavy vehicles carrying construction materials and equipment can pass.

② Establishment of Temporary Construction Yard

A temporary construction yard will be established at the backside of the proposed A1abutment by leveling a hill. The following facilities will be built in this construction yard:

- Site office, accommodation for laborers, laboratory, warehouse
- Girder fabrication facility and launching equipment
- Concrete batching plant
- Stock yard for aggregates

Another temporary yard should be provided in order to ensure the efficiency of the work on the left bank under the district buildings for storage of reinforcement and formworks for substructure construction.

③ Bridge Substructure Work

Provision of Temporary Substructure Access Roads

Temporary substructure access roads 4m in width shall be provided in the riverbed downstream of the bridge. Note that navigation clearance has to be provided for fishing boats at the crossing point for the Nam Lik River.

Substructure Access

Access to each substructure shall be provided from the above-mentioned 4m temporary access road. The elevation of the access road should be set at 181.0, which is the 2-year return period HWL during the dry season.

Provision of Artificial Island & Temporary Retaining Walls with Sheet-piles

Temporary retaining walls with sheet-piles shall be installed for excavation work for A1, P4 and A2 in order to prevent ground water from flowing in. The bottom edge of the sheet-piles should be inserted approximately 1.5m into the bedrock with a vibration hammer.

For P1, P2 and P3, artificial islands will be created around the piers to prevent river water from flowing in. Since the top surface of the artificial islands will be utilized as space for construction machinery, they should be 6m in width.

Excavation Work

An excavator will be utilized for excavation 5m or less in depth and a clamshell bucket for excavation deeper than 5m. For rock excavation, a breaker shall be used when required. Excavated soils at the A1 abutment will be reclaimed while soil at other substructure sites shall be stocked for filling works. A breaker will be utilized for rock excavation at P3 and will be stocked for filling work.

Substructure Works

After the placing of leveling concrete and setting reinforcements at their required positions, fresh concrete will be laid. Laitance shall be removed at the surface of construction joints in order to ensure integration of new and old concrete. False work should be provided around piers for those works.

Backfill

Backfill utilizing excavated soils shall be carried out with a bulldozer and vibrating roller at P1, P2, and P3. At A1, P4, and A2, a bulldozer and vibration roller will be utilized to compact backfills. Careful attention should be paid to compaction of backfills at A1 and A2 in order to prevent settlement.

Removal of Artificial Islands & Construction Yard

Removal of the artificial islands and construction yard shall be carried out after completion of the substructure works via leveling with a bulldozer.

④ Superstructure Work

The incremental launching method will be utilized for superstructure erection as this method enables work to continue even during the rainy season. There are two systems for the incremental launching method in terms of launching a girder; namely, the single driving force system and the multiple driving force system. For the Project, it is assumed that the single driving force system will be applied taking into consideration procurement and maintenance. Accordingly, the launching system will be attached to the A1 abutment and girders will be launched from the right bank towards the left bank. The work procedure is as shown in Figure 2.4.2 and the outline of each work item described below.

Launching Equipment

A girder fabrication yard shall be established at the backside of the A1 abutment. The yard will include various equipment and facilities for the efficient fabrication of girders. The yard should be located 40m from the A1 abutment. The space between the girder fabrication yard and A1 abutment will be utilized for the fabrication of the erection nose.

Note that the girder fabrication yard shall be covered with a roof to enable work to continue even on rainy days.

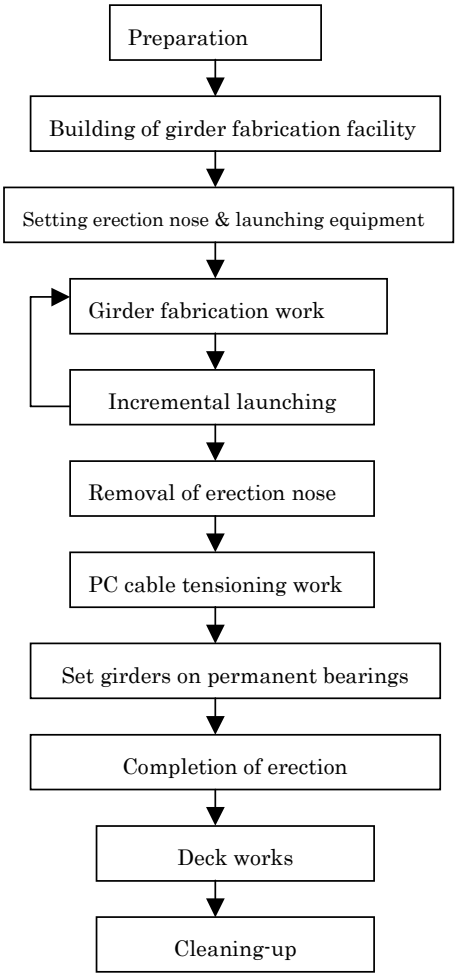

Figure 2.2.13 Work Procedure of Superstructure

Installation of Launching Equipment and Setting Erection Nose

Launching equipment shall be installed at the foreside of the A1 abutment. The length of the erection nose will be 31.5m as the maximum span is 45m.

Girder Fabrication

Girder fabrication work will be carried out under the roof and will include formwork, assembling of re-bars, arrangement of PC bars for the main girder and slabs, casting of concrete, and curing.

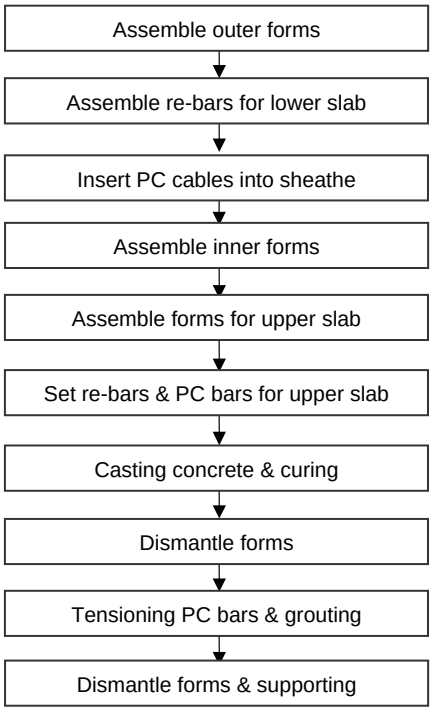

Figure 2.2.14 Procedure for Girder Fabrication

Bridge Deck Works

Finger-type expansion joints made of aluminum alloy will be adopted. When setting several factors, including the influence of creep, shrinkage of concrete, and air temperature, should be considered. Shrinkage-compensating mortar shall be utilized when setting the expansion joint.

A drainage catch-basin shall be set at approximately 10m intervals on the bridge deck during the fabrication of the main girders. Note that curbs and railings are installed after completion of the superstructure erection work.

⑤ Approach Road Works

The processes described below shall be applied in the approach road works.

Clearance & Grubbing Works

Prior to the earthwork, clearance and grubbing works will be carried out with an excavator and bulldozer.

Road Earthwork

Cutting work will be mainly done with an excavator except for the backside of the abutments. Excavated soil is carried to embankment sections and utilized for embanking. Excess soil

shall be carried to a designated disposal area. At embankment sections, appropriate materials for the roadbed will be used and filling and compaction carried out with a bulldozer and tire-roller.

Slope Works

Slopes of cut sections will be excavated with a machine up till 20-30cm before its final shape and final treatment carried out via manpower. The slope of embankments will be leveled with a bulldozer and treated with an excavator and finally covered by turf for protection.

Drainage Work

Concrete U-shaped drainage will be used for side ditches and berm drainage. A transverse RC pipe culvert shall be installed as required.

Pavement Work

Prior to surface treatment with asphalt emulsion, sub-base and base-course work shall be carried out. Sufficient compaction will be required for both of these works. As for surface treatment, the first treatment will include both the carriageway and paved shoulders and the second and final treatment only the carriageway.

(4) Utilization of Local Firms & the Dispatching of Japanese Technicians

1) Local Consultant

A Japanese superstructure engineer will be sent to site as necessary in addition to a Japanese resident engineer, as this is the first time for the incremental launching method to be used for superstructure erection in Lao PDR. Except for these two Japanese engineers, local support staff will be employed for all bridge and approach road works. Local engineers with sufficient capacity and experience in these fields are easily available because many road and bridge projects have been recently undertaken in Lao PDR.

2) Local Contractor

Utilization of local contractors should be encouraged for the Project because they have experience in bridge and road projects with foreign contractors. Regarding the superstructure work, utilization of local contractors will be limited because of the above-mentioned reasons. As for substructure work, a local contractor will supply machinery and manpower. On the other hand, as for the approach roads, a local contractor will take an active and leading role as they have much experience in this line of work.

3) Dispatch of Japanese Technicians

Japanese technicians, including a foreman, skilled technician for PC cable tensioning, and a

mechanic for superstructure erection work, should be sent as necessary in order to ensure safety and to keep to the construction schedule, as the erection method being applied is new.

(5) Implementation System for Project

Project implementation will be managed by the DoR of MCTPC. A Project Manager and Deputy Project Manager will be selected from the staff of DoR and they will belong to the Project Monitoring Division (PMD). After the completion of construction, all the facilities will be transferred to DCTPC of Vientiane Province for their operation and maintenance.

2.2.4.2 Implementation Conditions

(1) Technical Conditions

The Project consists of bridge, approach road, and ancillary works. Careful attention shall be paid to the following points for the superstructure works:

- Accuracy in the horizontal and vertical alignment of girders during the launching process can affect the final form and stress of girders. Therefore, girder positioning is crucial in erection work.
- Some works have to be carried out on the piers manually, such as the application of Teflon sheets to temporary bearings and the positioning of the main girders. Accordingly, attention should be given to safety education and measures for workers.
- The advantages of the incremental launching method include greater efficiency and reliability owing to repetitious work procedures that can be carried out throughout the year. Therefore, training and education of workers is most important to advantage of this.

(2) Social Environmental Conditions

Other major bridge work concerns common structures, including a wall-typed pier and box typed abutment with a spread foundation. Accordingly, safety and consideration for the social environment near the Project site are issues requiring consideration.

- Careful attention should be paid to work in the Nam Lik River, as the difference in water levels between the dry and rainy seasons is large and there can be sudden rises.
- The existing Hinheup Bridge will be utilized by the public even after the completion of the new bridge, so construction vehicles should be restricted from using it as they will damage the bridge even further and because it is necessary to secure pedestrian safety. Construction vehicles will therefore use temporary

access roads located 100m downstream.

- There are some good fishing points along the Nam Lik River near the bridge site. Therefore, consideration should be paid to the prevention of water pollution as well as to the operation of fishing boats.
- Electric power should be provided by the contractor for the construction works. Although there are electric lines nearby the Project site, capacity is insufficient for construction purposes. Furthermore, water for daily life and construction work should be provided by the contractor from a well or river, as there is no water supply system near the Project site.

(3) Critical GOL Responsibilities

Some undertakings of the GOL are critical in terms of the effect they can have on the construction schedule; namely, resettlement and land acquisition activities, land lease for temporary construction yards, and relocation of public facilities to be affected by construction. Figure 2.2.15 shows the candidate construction yards and the public facilities to be relocated.

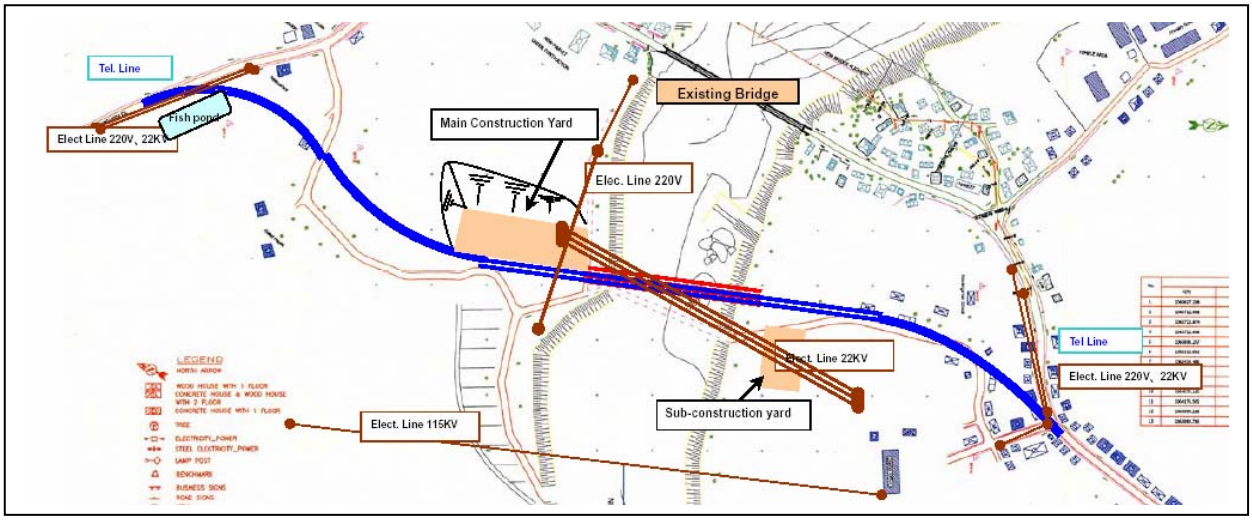

Figure 2.2.15 Candidate Construction Yards & Public Facilities to be Relocated

Table 2.2.25 shows the public facilities necessary to relocate.

Table 2.2.25 Public Facilities to be Relocated

Items	Both Left & Right Banks	
	Jurisdiction	Content
Electricity	Electricite du Laos: EDL	- Relocation of high voltage (22kv) & low voltage (220V) - Relocation of road lighting
Telephone	Lao Telecom	-Telephone lines along NR13N
Others	DCTPC	-Side ditches along NR13N

2.2.4.3 Scope of Works

To implement the Project under Japan's Grant Aid scheme, there are some works that both the GOJ and GOL must do (see Table 2.4.2).

Table 2.2.26 Tasks of Japanese & Lao PDR Sides

Responsibilities of Japanese Side	Responsibilities of Lao PDR Side
- Construction of bridges, approach roads and other necessary facilities.	- Land acquisition for construction and the securing of lands necessary for temporary facilities, such as girder manufacturing yards, stockpile areas for materials and equipment, etc.
- Provision of temporary construction yard and temporary roads to substructures and their removal. However, construction yard on the right bank will remain after construction.	- Compensation for relocation of houses.
- Procurement of materials, equipment and labor required for the above construction work.	- Removal or relocation of public utilities, such as electricity and telephone poles, etc.
- Supervision of the above construction work.	- Exemption from tax on materials and equipment imported for the Project and from custom clearance expenditures.
-Consultancy services required for Project implementation.	- Exemption from custom fees and taxation for Japanese and third party nationals entering Loa PDR to work for the Project, as well as exemptions from any other financial obligations.
	- Installation of road signs along the new approach roads.
	- Provision of power distribution facility for lighting on the new bridge.

2.2.4.4 Detailed Design and Construction Supervision

(1) Scope of Works for Consultancy Services

There shall be an Exchange of Notes (EN) between the Japanese and Lao Governments before the commencement of the Project. Followed by the EN, a contract for consultancy services between a Consultant, who shall possess a recommendation letter from JICA, and the MCTPC of Lao PDR shall be signed and the Consultant shall undertake the detailed design, assist with the preparation of tender documents, and the supervision of construction work. The major scope of the works for the consultancy services is described below.

1) Detailed Design & Assistance with Preparation of Tender Documents

In the detailed design stage, site reconnaissance including additional topographical and geological investigations will be conduced taking into account the Basic Design and the design conditions and specifications of MCTPC. Followed by the detailed design, tender documents shall be prepared and submitted to MCTPC for approval. The major contents of this work are as follows:

- Undertaking of detailed design based on additional surveys.

- Review of construction plan.
- Review of cost estimate.
- Preparation of “Instruction to Bidders” and contract documents for contractor.

2) Assistance for Bidding

The Consultant will assist MCTPC in executing the bidding for the Project. The major items where assistance will be provided are as follows:

- Notice of Tender
- Pre-qualification evaluation
- Pre-bid meeting and site visits, if necessary
- Evaluation of bidders
- Contract negotiations

3) Construction Supervision

After obtaining approval for the contract documents for the construction works from the GOJ, the Consultant will issue the “Notice to Proceed” to the Contractor and start its supervision work. During the construction period, the Consultant will oversee the quality and safety of the works, execute the administrative work for payment, and make recommendations on working methods to the Contractor. Furthermore, the Consultant will coordinate as necessary with the relevant organizations, including JICA, the Embassy of Japan in Lao PDR, and the GOL. The contents of the major activities of the Consultant are as described in Table 2.2.27.

Table 2.2.27 Supervision Items during Construction Stage

Supervision Items	Contents
① Approval of construction schedule & drawings	-To inspect and approve construction schedule and shop drawings submitted by Contractor. -To check if submitted documents are in accordance with contract documents and drawings, specifications, etc.
②Schedule control	-To receive progress reports from the Contractor and to give instructions to ensure completion of the Project on schedule.
③Quality control	-To examine the quality of works and approve construction materials and construction methods by making reference to the contract drawings and specifications.
④Inspection of completed construction works	-To inspect and give approval for completed work and final quantities for payment by checking as-built drawings.
⑤Issuing of certification	-To issue the necessary certificates for payment for completion of construction and for the expiry of the warranty period to the Contractor.
⑥Submission of reports	-To inspect monthly reports, as-built drawings and photos prepared by the Contractor for submittal to the GOL, JICA, etc. -To prepare a final report at the completion of construction and to submit it to JICA.

(2) Organization of Consultancy Services

1) Consultant Organization for Detailed Design & Tendering Assistance

Since the Project is to be implemented as a Japan Grant Aid Scheme, the following shall be required in the tender process:

- To provide “Instruction to Bidders” and draft contractual documents in accordance with the guidelines of Japan’s Grant Aid scheme.
- To allocate engineers involved in the BD Study for this work.

Six experts shall be allocated for the work of undertaking the detailed design and preparing tender documents and supporting the Client in the bidding process.

Table 2.2.28 Experts for Detailed Design, Bidding Document Preparation, & Bidding Process Assistance

Name	Roles
Project Manager	Manage & supervise all activities of the Consultant in both the detailed design and tendering process.
Road Engineer	- Undertake the detailed design of approach roads (including alignment settling, drainage facilities, revetment work, etc.).
Bridge Engineer for Superstructure	- Review construction plan for superstructure erection & hold discussions with MCTPC. - Finalize design conditions & specifications, examine the erection method & plan, and conduct superstructure design.
Bridge Engineer for Substructure	- Review construction plan for substructure & hold discussions with MCTPC. - Finalize the design conditions and specifications, examine the substructure type and conduct substructure design.
Construction Planner/ Cost Estimator	- Review of construction planning for both substructure & superstructure. - Provide comparison table between BD & DD results.
Document Specialist	- Finalize tender documents including technical specifications on the basis of the Study results and support the Client in the bidding process. - Provide tender evaluation report.

2) Consultant’s Organization during Construction Supervision

A resident engineer, who has experience with at least both PC bridge projects and Japanese Grant Aid, shall be assigned throughout the entirety of the construction in order to ensure the success of the first application of incremental launching method in Lao PDR. A Project Manager shall visit the site when required in order to check the progress of the Project as well as to coordinate with the relevant organizations.

A bridge engineer shall be assigned to support the resident engineer as necessary to ensure

the quality of the erection and PC cable tensioning work, which can have a large impact on the entire quality of the bridge.

Table 2.2.29 Consultant's Organization for Construction Supervision

Name	Roles & Activities
Project Manger	- Confirm the progress of major work items & coordinate the relevant organizations, including JICA, the Embassy of Japan, and the GOL.
Resident Engineer	- Supervise both bridge and approach road works & carry out daily supervision works jointly with the bridge engineer. - Report to JICA, Embassy of Japan & MCTPC periodically.
Bridge Engineer	- Confirm the construction planning for the incremental launching method & PC tensioning procedures/plans. - Supervise the daily works of the Contractor & give instructions as necessary. - Supervise the tensioning of PC cables & girder erection work.

2.2.4.5 Procurement Plan

(1) Labor Conditions

1) Engineers & Technicians

In the past, many Lao engineers graduated from universities in Russia and Eastern Europe. However, recently, many young Lao engineers are graduating from universities in Thailand, Australia, the US, Japan and China, and most of them possess basic engineering knowledge and skills in addition to good English speaking and writing skills.

On the other hand, changes in higher education have been proceeding in Lao PDR, and 3 colleges and 8 higher educational institutes were integrated into Lao PDR's first university in 1995. Lao University comprises 10 faculties, including engineering and architecture, and many students graduate from the engineering and science fields.

2) Skilled Labor from Third Countries

It is not difficult for skilled labor from a third country to obtain a working visa for ODA projects. Recently, many engineering firms have moved into the Lao market because the GOL welcomes advanced technology from foreign countries. However, it is difficult for unskilled labor from a third country to obtain a working visa.

(2) Domestic & Overseas Procurement

Local materials defined as domestic products or available in the domestic market shall receive high priority in Project procurement. The following describes the quality and procurement conditions of the major construction materials.

1) Cement

Lao Cement Company Limited, which is jointly operated with a Chinese firm, is the only company to produce cement in Lao PDR. The factory is located in 70km north of Vientiane Municipality and it has two producing plants. This brand of cement is widely available in the domestic market. Based on interviews with contractors, it was pointed out that Lao cement is unsuitable as a high-strength concrete. Therefore, local cement will be used for the substructure and other concrete structures that require only lower-strength concrete. For PC concrete for the superstructure, cement produced in Thailand will be used as it possesses the requisite strength.

2) Fresh Concrete

There are many fresh concrete plants in Vientiane Municipality. However, they are far from the

Project site. Accordingly, a concrete plant should be installed at the construction yard of the Project site in order to secure a stable supply of good quality concrete.

3) Concrete Aggregate & Base Course Materials

Stones from the Mekong River are widely available as aggregate for concrete. However, since those aggregates have the high possibility of causing an alkali-silica reaction, they can not be used for the Project. Accordingly, stones or rocks available near Vang Vieng will be utilized as aggregate. However, since the crushing plan at Vang Vieng has low production capacity, it is assumed that the raw materials will be carried to a high-capacity crushing plant located near Nam Ngum.

4) Fine Aggregates for Concrete & Asphalt

Fine aggregates and sand from the Mekong River are widely available in the domestic market. However, it is necessary to test the materials in the laboratory in order to confirm their quality as it varies widely.

5) Embankment Materials

It has been confirmed that embankment materials of good quality are available from a borrow pit near the Project site. Accordingly, it is necessary to get permission for taking these materials from the local authority.

6) Bituminous Materials

Although there are some asphalt-mixing plants in Vientiane Municipality, all bituminous materials are imported from Thailand. It has been deemed, on the other hand, that the supply of bituminous materials from these plants is possible. However, it is necessary to pay attention to the temperature control of the materials during transport. In addition, in the case of applying bituminous materials on the bridge deck, attention should be paid to the mixture of the asphalt concrete taking into account climatic conditions.

7) Steel Materials (Re-bars, PC bars & cables)

For re-bars less than 20mm in diameter, which would be limited to use for small RC structures such as drainage facilities, local materials are sufficient. However, for the bridge structure, steel materials will be procured from Thailand for reasons of quality and stability of supply. For other steel materials, including sheet piles and structural members for girder fabrication equipment, these shall also be procured from Thailand.

8) Wood

Wood is basically available from the domestic market. However, thick plywood for formwork will be procured from Thailand.

9) Procurement Source of Major Materials

The procurement sources for major materials are summarized in Table 2.2.30.

Table 2.2.30 Procurement Sources of Major Materials

Name	Locally procured	Procured from third County	Procured in Japan	Remarks
Cement	○	○		For high strength: Thailand product For others: Lao product
Concrete admixture	○			Imported from Thailand
Reinforcement	○	○		Large diameter ones from Thailand
Structural steels	○			Imported from Thailand
Pc bar & cables		○	○	Procured from Thailand or Japan
Bituminous materials	○			Imported from Thailand
Crushed stone, sand	○			
Form(plywood)	○			Imported from Thailand
False work & scaffolding		○		Procured from Thailand
RC pipe	○			
Expansion joint		○		Procured from Thailand
Bearing		○		Procured from Thailand

(3) Construction Machinery and Equipment

1) Procurement Condition of Construction Machinery in Lao PDR

Due to the many recent road and bridge projects in Lao PDR, common construction machinery and equipment is available in the domestic market mainly from local contactors. However, the availability of special machinery or equipment is limited. Below, the procurement conditions of major machinery and equipment are described in detail.

2) State Enterprises

State enterprises own many types of construction machinery and equipment for road and bridge projects. Some of them may be available for the Project.

3) Private Contractors

Although common construction machinery and equipment are basically available, there is a limited amount. As for special machinery and equipment, such as a crane with 50-ton lifting

capacity, large vibrating hammers, or jet-water digging machines, they are scare and shall be procured from Thailand. Note that a leasing business for construction machinery (i.e., Lao-Singapore Co., Ltd) just started operation in Lao PDR and deals with Caterpillar brand machinery (including repair and maintenance work).

4) Machinery & Equipment Owned by Foreign Firms

Most foreign firms own asphalt mixing, concrete mixing and crushing plants. However, their availability is limited due to ongoing usage.

5) Procurement Sources for Major Machinery & Equipment

Table 2.2.31 summarizes the procurement sources for major machinery and equipment for the Project.

Table 2.2.31 Procurement Source of Major Machinery and Equipment

	Item	Q'ty	Specification	Domestic	Imported
Ⅰ.	Earth Work, Cofferdam Work				
1	back hoe	4	0.7m3	○	
2	dump truck	8	11.0t	○	
3	crawler crane	2	60t mechanical		○
4	truck crane	2	25t	○	
5	truck crane	2	45t		○
6	vibro hammer	2	90kw		○
7	electric generator	2	400KVA		○
8	water-jet	2	150kg/cm2		○
9	clamshell bucket	2	0.6m3		○
10	giant rock breaker	2	600kg		○
11	rock breaker	6	B30		○
12	crawler drill	2	150kg		○
13	air compressor	4	7m3	○	
14	submersible pump	4	φ4″	○	
15	submersible pump	12	φ6″		○
16	electric generator	4	45KVA	○	
17	road roller	2	1.0t	○	
18	impact tamping rammer	2	60kg	○	
19	earth auger machine	2	φ1200		○
20	hydraulic jacked pile driver	2	φ1200		○
21	φ1200 casing	2	φ1200		○
22	hammer grab bucket	2	φ1200		○
23	core barrel bucket	2	φ1200		○
24	slurry plant	2			○
25	tremie pipe	2			○
26	welding machine	4		○	
27	gas cutter	2		○	
Ⅱ.	Concrete Work, PC Work				
28	electric generator	2	75KVA	○	
29	concrete mixer	2	0.5m3	○	
30	batching plant	2	0.5m3		○
31	cement silo	2	200t		○
32	aggregate weigher	2	Double scalepan		○
33	agitator car	6	5.0m3	○	
34	concrete bucket	4	0.5m3	○	
35	crawler crane	2	60t mechanical		○
36	concrete pump	2	90m3/h	○	
37	electric vibrator	16	φ48mm		○
38	electric vibrator	8	φ58mm		○
39	electric converter	12			○
40	bar cutter	2	C-42	○	
41	bar bender	2	B-42	○	
42	submersible pump	4	φ4″	○	
43	welding machine	5		○	
44	electric generator	2	250KVA	○	
45	jet washer	2			○

	Item	Q'ty	Specification	Domestic	Imported
Ⅲ.	Road Construction Work				
46	road roller	1	10.0t	○	
47	road roller	1	1.0t	○	
48	distributor	1	1000L	○	
49	macadam roller	1	10.0t	○	
50	asphalt finisher	1	4.0t	○	
51	rubber-tyred roller	1	10.0t	○	
52	watering cart	1	2000L	○	
53	bulldozer	1	D-4	○	
54	motorgrader	1	3.5m	○	
55	asphalt cutter	1		○	
56	core piece cutter	1		○	
Ⅳ.	PC-girder fabrication, Extruded Construction Method				
57	rolley hoist	1	2.8ton		○
58	portal crane	4	5t		○
59	air vibrator	12			○
60	electric vibrator	8	φ58mm		○
61	electric converter	12			○
62	bar cutter	2	C-42		○
63	bar bender	2	B-42		○
64	hydraulic jack	8	60t		○
65	journal jack	14	30t		○
66	hydraulic pump	8	C-42		○
67	jack & pump for tensioning	2	195t		○
68	jack & pump for steel bar	2	φ32mm		○
69	grout mixer	2			○
70	grout pump	2			○
71	form units	1			○
72	concrete pump	2	90m3/h		○
73	jack for extrusion	2	170ton-500stroke		○
74	hydraulic unit	1			○
75	prestressing steel bar	4	φ32mm,L=20m		○
76	tensioning bracket	2			○
77	reaction pedestal	2			○
78	guide beam jack	2	50ton-200stroke		○
79	bent piers	1			○
80	sliding expansion bearing	4			○
81	vertical jack	2	600ton-70stroke		○

2.2.4.6 Quality Control Plan

There are no integrated technical specifications for quality control for road and bridge construction in Lao PDR. Accordingly, Japanese specifications are applied. The draft specifications for the major work items are as shown in Table 2.2.32.

Table 2.2.32 Quality Control Plan (Draft)

Type of Work	Item Concerned	Inspection, Testing, etc.	Frequency of Inspection/Testing
1)Earthworks Filling, base course, backfilling soil of structures	Material	Soil test of embankment materials - Specific gravity of soil particles/Soil water content/Soil particle size/Plasticity limits of soil/Soil compaction/Dry density/CBR test	Before start of work
	Daily Management	Embankment construction test - Control of compaction density (sand replacement method, etc.)	-Immediately after execution of work -Once a day for each layer placed
DBST Pavement Works	Material	Bituminous coat test - Common physical test/ density	Before start of work
	Daily Management	Distribution volume test	During work: Once a day
Concrete Structures	Batching Plant	Weighing equipment, mixing efficiency - Static load test/Weighing controller /Dynamic load test / Mixing efficiency	Before implementation, monthly (every 3 months in case of dynamic load)
	Materials	Cement, water - Checked by means of standard certificate Fine and coarse aggregate tests - Particle size/Specific gravity/Water absorption/Unit weight/Durability/ Alkali-aggregate reaction	Before commencement & after change of materials
	Concrete standard test	Test mixing to determine mix proportion - Slump/Air content/Temperature/Strength of test piece	Before commencement
	Daily Management	Fresh concrete - Air content /Slump/Temperature	Initial consecutive five units. Subsequently, every 50m^3 and at preparation of sample
		Concrete casting method - Casting method/ Vibrating/Order of Placing/Joint position/Curing method/ Removal Laitance	Witness inspection at placement
		Concrete sample - Sample compressive strength test - Preparation of the concrete control chart	Sample to be prepared once a day 7 and 28 days after placement

Reinforced bar, forms, PC cable	Materials	Check reinforced bars and pre-stressed cable using mill sheet issued by manufacturer - Quality /Tensile test/ Bending test	Before implementation
	Inspection of Works, Daily Management	The following checks should be made after assembly: - Material size/ Dimensions/Layout/Lap length/Concrete cover/ Fixing condition / joint treatment condition	Before placement of concrete: 100% inspection of each placement area
Pre-stressing of PC cable	Concrete strength check	- Concrete sample compressive strength	Before pre-stressing
	Pre-stressing equipment	- Calibration of jack and pump	Before pre-stressing, Every 50 pre-stressed cables With change of pre-stressing equipment
	Pre-stressing test	- According to pre-stressing control chart	Before final pre-stressing
	Pre-stressing control	- Control of each cable/Control of cable group/Control of transverse pre-stressed cable	At pre-stressing Pre-stressing control chart
PC grouting	Mixing design	- Consistency/Bleeding ratio/Expansion ratio/Strength /Total salt content	Before use
	Daily Management	-Consistency -Temperature	Once a day, every five batches
		- Bleeding ratio/Expansion ratio/ Compressive strength	Once a day
Staying Cable	Materials	- Mill sheet issued by the manufacturer, tension test, bending test	Before commencement
	Tension device	- Calibration of jack and pump	Before tensioning
	Tension test	- In accordance with tension control chart	Before final tensioning
	Tension control	- Control of each cable	At tensioning (tension control chart)
Grouting for Staying Cable	Mixing design	- Consistency/Temperature/Bleeding ratio/ Expansion ratio/ Compressive strength	Before use
	Daily Management	- Consistency/Temperature/Bleeding ratio/ Expansion ratio/Compressive strength	At treatment with grouting

Table 2.2.33 shows the draft tolerance control plan for the proposed facilities in the Project.

Table 2.2.33 Tolerance Control Plan (Draft)

Construction	Type	Item	Standard value	Remarks
Earthwork	Base-course preparation	Design height	+2 cm to -5 cm	20m interval
		Width	More than design value	Ditto
	Granular base course	Design height	±3 cm	Ditto
		Deviation from design height at 2 points within 20m distance	2 cm or less	Ditto
		Finish thickness	90% of design value	Ditto
		Width	More than design value	Ditto
Pavement work	DBST pavement	Width	Less than 3cm	Ditto
		Thickness	Less than 1.5cm	Ditto
Foundation	Spread foundation	Base height	Less than design height	4m mesh
Concrete structures	Footing	Design height	±5 cm	
		Thickness	±75 mm or ±3%	
	Piers, abutments, retaining walls	Plane position	±30 mm	
		Design height	-30 mm to +10 mm	
		Crown height, width	±30 mm	
		Section dimensions	-10 mm to +20 mm or±2%	
	Slabs	Bridge length	-25 mm to +30 mm	
		Width	0 to +20 mm	
		Slab/curb height	-25 mm to +25 mm	
		Thickness	0 to +20 mm	
Pre-stressed concrete structures	Post-tensioned girders	Member length	-25 mm to +30 mm	

2.2.4.7 Implementation Plan

Figure 2.2.16 shows the tentative Project implementation schedule based on the Study's results. Followed by the Exchange of Notes, the detailed design, the preparation of tender documents and then tendering will be carried out to be followed by construction.

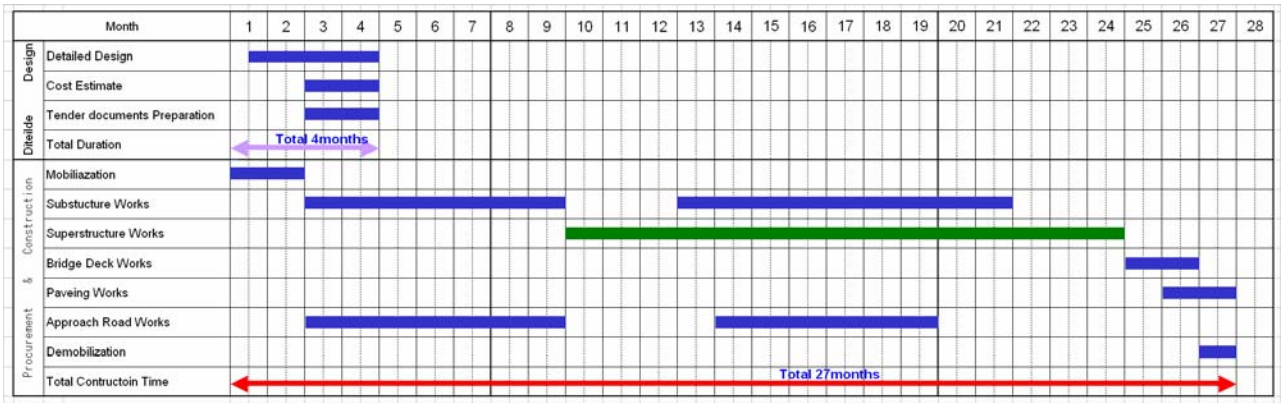

Figure 2.2.16 Tentative Project Implementation Schedule

2.3 Obligations of Recipient Country

The obligations of the GOL are listed below.

- Compensation for relocation of houses from construction sites and provision of new land for new settlers with required infrastructure.
- Acquisition of construction sites and lands necessary to perform temporary works (PC girder manufacturing, stockpiling of materials and equipment, and repairing of equipment and materials such as formwork & re-bars).
- Removal or relocation of public utilities, such as electric cables, and telephone cables.
- Permission for obtaining borrow materials.
- Exemption of tax on materials and equipment imported for the Project and prompt customs clearance.
- Exemption from custom fees and taxation for Japanese and third party nationals entering Lao PDR to work for the Project, and exemption from any other financial obligations.
- Installation of road signs along the new approach roads.
- Provision of power distribution facility for lighting on the new bridge.

2.4 Project Operation & Maintenance Plan

2.4.1 Operation & Maintenance System

The proper maintenance and operation of the new bridge and approach roads are vital in order to secure their function over a long period of time. The present maintenance and operation system of the provincial DCTPC seems sufficient to keep the new facilities in good condition. Accordingly, it has been deemed that a new system or organization for maintaining the new facilities is not required

2.4.2 Inspection & Maintenance Method

(1) Periodic Inspection & Maintenance

The bridge structures and approach roads shall be maintained by the Vientiane Province DCTPC. Table 2.4.1 indicates the recommended intervention levels for the inspection and maintenance of the new facilities. Note that it is recommended that inspections be executed before and after the rainy season.

Table 2.4.1 Maintenance & Inspection Schedule

Facility	Item	Maintenance & Repair Works	Inspection Interval
Bridge	① Drainage pipe	Clearing of sediment	3 months
	② Expansion joint	Inspection of looseness of expansion joint and clearing of sediment	3 months
	③ Railing	Repairing damage from collisions	3 months
	④ Bearing	Removal of soil deposits & grasses	6 months
	⑤ Asphalt pavement	Repairing of cracks	6 months
	⑥ Substructure	Removal of debris, Inspection of scouring	6 months
	⑦ Around substructures	Repair of stone masonry & gabions	6 months
Road	① Pavement	Patching, smoothing	3 months
	② Backside of abutments	Repair of height difference	6 months
	③ Shoulder/slope	Planting turf, reinforcement of soils, repairing riprap	3 months
	④ Drainage	Clearing of sediment and debris	3 months

(2) Maintenance of Approach Roads

It is anticipated that settlement at the backside of abutments will occur even if an approach slab is installed. Accordingly, regular inspection checks should be carried out to observe for settlement or height differences between the abutment and approach road. Should damage be observed, prompt repair works, including patching, repair of cracks and ruts, should be executed. It is recommended that the approach roads receive an overlay every 5 years.

2.5 Project Cost Estimation

2.5.1 Construction Cost

(1) Cost Estimate

The total costs of the Project under Japan's Grant Aid scheme are summarized in Table 2.5.1. This cost estimate is provisional and will be further refined by the GOJ when approving the Grant. In addition, these approximate Project costs do not represent the maximum amount of Japan's Grant Aid to be contained in the Exchange of Notes.

Approximate Project Costs: 1,011.3 Million Japanese Yen

Table 2.5.1 Approximate Project Costs (unit: Japanese Yen)

For 195m Bridge & 755m of approach road

Project Costs			Million Japanese Yen
Facility	Bridge	Substructure Superstructure Approach roads Other facilities	864.3
Tendering Support & Construction Supervision			117.0
Total Cost			981.3

(2) Premises of Estimation

① Time of estimate : April 2006
② Exchange rate :1US$ = JPY118.18, 1US$= 10,631LAK
③ Implementation period : Tendering process & construction period shown in Implementation Schedule
④ Others : On the condition that the Project is implemented with Japanese Grant Aid. The above-mentioned exchange rate is to be reviewed by the Government of Japan.

(3) Cost Borne by Lao PDR Government

The approximate costs required for the tasks to be undertaken by the GOL are as shown in Table 5.2.

Table 2.5.2 Approximate Costs to be Borne by Lao Government

Items	Cost: US$ (Million JPY)
Land acquisition	50,000- (5.90)
Resettlement	70.000- (8.27)
Removal/relocation of public utilities	75,000- (8.86)
Installation of road signs	25,000- (2.95)
Power distribution facility for lighting on new bridge	35,000- (4.14)
Total amount	255,000- (30.12)

* The above-mentioned costs are estimates subject to review.

2.5.2 Operation & Maintenance Cost

The following maintenance cost shown in Table 2.5.3 will be borne by the GOL for 10 years after commencement of operation. The major facilities subject to maintenance are as listed below:

- PC box girder bridge :195m
- Approach roads : 0.755km
- Pavement Width : DBST (7m for approach road), Asphalt concrete:10m for bridge
- Slopes : Cut section:8000m^2, Embankment section:3200m^2
- Revetment : Gabion (3900m^2), Stone masonry (700m^2)

Table 2.5.3 Operation & Maintenance for Project Road

Period	Works	Specification	Unit Price (US$)	Unit	Quantity	Years	Total（US$）
Routine Maintenance (Approach road) (every year)	**Approach Rd.**						
	Repair of pave.	1.0% of total area / year	4.0	m^2	53	8	1,698.0
	Slope repair	0.5% of total area / year	2.2	m^2	112	8	1971.2
	Bridge						
	Repair of deck	1.0% of total area / year	4.0	m^2	19.5	8	624.0
	Operation cost	20% of above					858.6
	Sub-total for routine maintenance (for 8 years)						
Periodic Maintenance (Bridge/Approach road) (5th&10th year)	**Approach Rd.**						
	Repair of pave.	Overlay	4.0	m^2	5285	2	42,280.0
	Slope repair	5% of total area	2.2	m^2	560	2	2,464.0
	Bridge						
	Repair of deck	Overlay	24.6	m^2	1950	1	47,970.0
	Repair of railing & curbs	5% of total area	10.5	m^2	19.5	1	204.8
	Revetment						
	Gabion	5% of total area	22.0	m^2	197	2	8,668.0
	Sub-total for periodic maintenance (per time)						
Operation & Maintenance Cost		10% of Sub-total	1	lot		1	10,158.0
10 years Total Operation & Maintenance Cost							116,896.6
(Average maintenance cost per year)							(11,690)

The total operation and maintenance cost for the new facilities by Vientiane Province DCTPC is estimated at US$ 11,690/year and accounts approximately for 2.7% of the maintenance budget (US$432,400) of the province for NR13N in 2005.

CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATIONS

Chapter 3 Project Evaluation & Recommendations

3.1 Project Effect

The Project aims to secure the safe and smooth passage of road traffic on NR 13N by constructing a new Hinheup Bridge, which is the last temporary bridge on NR13N. This improvement is expected to contribute to achieving the objectives of the Project as well as promoting the goals of the national development plan, which are to encourage economic development of the country (including the northern area) and to reduce poverty. Direct beneficiaries are estimated to total about 2.857 million people and consist of people living in Vientiane Municipality, Vientiane Province and the northern area of Lao PDR. As for indirect beneficiaries, they are estimated at about 2.361 million people and living in other areas. Below, the direct and indirect effects of the Project are described.

(1) Direct Effects

Table 3.1.1 Measurement of Direct Effects

Present Status & Issues	Project Countermeasures	Impact of Project
1. Poor transport capacity of existing bridge. - Existing bridge has only a 15-ton capability for passing traffic.	The new bridge is designed with the live load equivalent to 25 ton capacity for transport	The capacity for transport of the new bridge will be strengthened and it ensures the safe and smooth traffic on NR13N.
2. Waiting time Existing bridge width is insufficient for 2-way traffic & waiting sometimes necessary. -Waiting time: 0 - 2 minutes -No. of vehicles waiting: 0 - 5	Provision of 8m carriageway (including the shoulder) will enable 2-way operation	Waiting time will be eliminated and smooth passage of vehicles achieved.
3.Passing time Narrow width and low stiffness of existing superstructure causes reduction in vehicle speed, requiring longer crossing times. - Sedan: 18 sec. - Heavy vehicle: 40 sec.	New bridge will provide sufficient width for vehicles passing each other and sufficient stiffness will eliminate adverse effects on smooth driving.	Crossing time for heavy vehicle will be reduced to14 seconds and smoother driving realized.
4. Pedestrian safety - Narrow footpath and no shoulder of bridge carriageway exposes pedestrians to danger	Provision of 1m footpath and 0.5m shoulder on both sides of carriageway & separation of footpath from carriageway with curb.	This provision will improve pedestrian safety.
5. Noise from vehicles crossing bridge Vehicles crossing the existing steel deck results in large noise levels and has an adverse impact on residents nearby.	Concrete slab covered with asphalt for new bridge.	Stiff concrete deck slab & flexible asphalt pavement will reduce noise from vehicles crossing the bridge.

(2) Indirect Effects

Table 3.1.2 Measurement of Indirect Effects

Present Status & Issues	Project Countermeasures	Project Impacts
1.Revitalization of economy (including tourism) in the northern area Average daily weekday traffic - Motorbike:1051 - Sedan: 494 - Bus: 131 -Truck: 530 Total: 2,206	-New bridge construction with 25 ton capacity for transport	The following items will be compared in order to measure the contribution of the Project in revitalizing the economy of the northern area. -Daily traffic by vehicle type -No. of trucks as proxy for measuring economic activity -No. of buses as proxy for measuring tourism activity - Change in number of tourists visiting Luang Prabang via land transport.
2.Revitalization of Hinheup North & South villages 1) Area development plan Not yet in concrete form	-New bridge construction	Area development plan will be formulated in concrete form
2) Area economic activities		Business in area will be stimulated due to increase in traffic volume - Interview with shop owners
3) Population (1,565 people as of December 2005)		Increase in no of households & population - Population & household census

3.2 Recommendations

Some activities that should be carried out by the GOL to promote the Project and sustain its benefits are described below.

① Execution of IEE Study for Selected Route

An IEE is scheduled for execution based on the results of the Basic Design Study by ESD by the end of October 2006, and approval from STEA should be obtained by the end of November 2006. It is essential for the GOL to adhere to this schedule in order to ensure the approval of the Japanese Grant Aid scheme.

② Execution of Appropriate Resettlement Activities

Although it was confirmed that villagers near the new Hinheup Bridge support the Project, they strongly asked for appropriate compensation for lost property and for the provision of new land. It is indispensable for the GOL to implement resettlement

activities in a timely and acceptable manner, which includes land acquisition, compensation and resettlement prior to the commencement of construction in accordance with laws and regulations related to resettlement.

③ Execution of Proper Maintenance for New Bridges & Approach Roads

Owing to the RMF being introduced by the GOL in 2001, it has been deemed that appropriate maintenance for the new bridge and approach roads can be executed. However, it is recommended that the Japanese side occasionally monitor the operation and maintenance activities.

APPENDICES

TRAFFIC COUNT SURVEY RESULTS

GEOLOGICAL INVESTIGATION RESULTS

ROAD NOTE 31 PAVEMENT STRUCTURE TABLE

Appendix-1 Traffic Count Survey Results

（Weekday：March 23 (Thursday), AM6:00-PM6:00）

	Pedestrian	Bicycle	Motor bike	Sedan	Pick-up	Small bus	Larch bus	Truck 2axle	Truck 3 axle	Truck 4axle	Agricultural purpose	total
To Luang Pabang	229	1	318	108	112	15	35	108	55	21	4	777
To Vientiane	307	5	491	18	142	24	27	112	56	56	4	935
Total	536	6	809	126	254	39	62	220	111	77	8	1712

（Holyday：March 26, 2006 (Sunday), AM6:00-PM6:00）

	Pedestrian	Bicycle	Motor bike	Sedan	Pick-up	Small bus	Larch bus	Truck 2axle	Truck 3 axle	Truck 4axle	Agricultural purpose	Total
To Luang Pabang	55	5	288	75	108	19	29	67	21	15	1	628
To Vientiane	55	5	376	46	158	30	26	89	18	33	2	783
total	110	10	664	121	266	49	55	156	39	48	3	1411

Appendix-2　Geological Survey Results

BH-1（Left bank A1 Position）

PROJECT : Construction of New Hinheup Bridge Project
BORING No. BH 01

BORING LOG
ASTM METHOD D. 1586 FOR S.P.T
PENETRATION TEST

REPORT SHEET
DATE : 06/04/2006
ENGINEER : Phongkham

SCALE (m)	ELEVATION (m)	DEPTH (m)	LAYER THICKNESS (m)	OBSERVATION RECORD SYMBOL	SOIL DESCRIPTION	DEPTH (m)	QU (kg/cm2)	NUMBER OF BLOW PER 30 cm	N . VALUE	Consistency
1	2	3	4	5	6	7	8	9	10 20 30 40 50 60 70 80 90 100	11
1.00	190.107	0.00				1.00	1.51	14		Stiff
2.00						2.00	1.72	16		Very stiff
3.00						3.00	2.04	19		Very stiff
4.00					Yellowish red, silty clays (CL).	4.00	2.26	21		Very stiff
5.00			8.00			5.00	1.94	18		Very stiff
6.00						6.00	2.04	19		Very stiff
7.00						7.00	2.15	20		Very stiff
8.00	182.107	8.00				8.00	>7.00	>70		Very dense
9.00			2.00	× × × × × ×	Brown, silty fine sadas (ML).	9.00	>7.00	>70		Very dense
10.00	180.107	10.00				10.00				
11.00						10.50	190	-	▽ 179.60	Very dense
12.00						11.50	207	-		Very dense
13.00			5.00		Grayish red, sandstone.	12.50	150	-		Very dense
14.00						13.50	282	-		Very dense
15.00	175.107	15.00			End of drilling.	14.50	403	-		Very dense

REMARKS :　N : BLOW PER 30cm (63.5Kg HAMMER 76cm DROP 5cm SAMPLER)
QU : UNCONFINED COMPRESSIVE STRENGTH (Kg / cm2)

Figure A-6 Geological Profile of Bore Hole BH 01

BH-2：P1 position

PROJECT : Construction of New Hinheup Bridge Project
BORING No. BH 02

BORING LOG
ASTM METHOD D. 1586 FOR S.P.T
PENETRATION TEST

REPORT SHEET
DATE : 06/04/2006
ENGINEER : Phongkham

SCALE (m)	ELEVATION (m)	DEPTH (m)	LAYER THICKNESS (m)	OBSERVATION RECORD SYMBOL	SOIL DESCRIPTION	DEPTH (m)	QU (kg/cm2)	NUMBER OF BLOW PER 30 cm	N . VALUE	Consistency
1	2	3	4	5	6	7	8	9	10 20 30 40 50 60 70 80 90 100	11
0.50	178.642	0.00				0.50	469	-		Very dense
1.00						1.00				
1.50						1.50	369	-		Very dense
2.00						2.00				
2.50						2.50	350	-	▽ 178.10	Very dense
3.00			5.00		Grayish red, sandstone.	3.00				
3.50						3.50	399	-		Very dense
4.00						4.00				
4.50						4.50	345	-		Very dense
5.00	173.642	5.00			End of drilling.	5.00				

REMARKS :　N : BLOW PER 30cm (63.5Kg HAMMER 76cm DROP 5cm SAMPLER)
QU : UNCONFINED COMPRESSIVE STRENGTH (Kg / cm2)

Figure A-7 Geological Profile of Bore Hole BH 02

BH-3　P3 position

PROJECT : Construction of New Hinheup Bridge Project.
BORING No. BH 03

BORING LOG
ASTM METHOD D. 1586 FOR S.P.T
PENETRATION TEST

REPORT SHEET
DATE : 06/04/2006
ENGINEER : Phongkham

SCALE (m)	ELEVATION (m)	DEPTH (m)	LAYER THICKNESS (m)	OBSERVATION RECORD SYMBOL	SOIL DESCRIPTION	DEPTH (m)	QU (kg/cm2)	NUMBER OF BLOW PER 30 cm	N. VALUE 10 20 30 40 50 60 70 80 90 100	Consistency
1	2	3	4	5	6	7	8	9		11
	179.298	0.20	0.20		Grayish red, sandstone.					
0.50	179.090		0.60		Brown, silty sands (SM).	0.50				
1.00	178.490	0.80				1.00	236	-		Very dense
1.50						1.50				
2.00						2.00	354	-	▽ 177.20	Very dense
2.50						2.50				
3.00						3.00	250	-		Very dense
3.50			5.20		Grayish red, sandstone.	3.50				
4.00						4.00	202	-		Very dense
4.50						4.50				
5.00						5.00	191	-		Very dense
5.50						5.50				
6.00	173.290	6.00			End of drilling.	6.00				

REMARKS : N : BLOW PER 30cm (63.5Kg HAMMER 76cm DROP 5cm SAMPLER)
QU : UNCONFINED COMPRESSIVE STRENGTH (Kg / cm2)

Figure A-8 Geological Profile of Bore Hole BH 03

BH-4 : P4 position

PROJECT : Construction of New Hinheup Bridge Project
BORING No. BH 04

BORING LOG
ASTM METHOD D. 1586 FOR S.P.T
PENETRATION TEST

REPORT SHEET
DATE : 06/04/2006
ENGINEER : Phongkham

SCALE (m)	ELEVATION (m)	DEPTH (m)	LAYER THICKNESS (m)	OBSERVATION RECORD SYMBOL	SOIL DESCRIPTION	DEPTH (m)	QU (kg/cm2)	NUMBER OF BLOW PER 30 cm	N. VALUE 10 20 30 40 50 60 70 80 90 100	Consistency
1	2	3	4	5	6	7	8	9		11
0.50	181.228	0.00	0.90		Dark yellowish brown, silty sands (SM).	0.50				
1.00	180.328	0.90				1.00				Very dense
1.50		1.50	0.60		Grayish red, sandstone.	1.50				Very dense
2.00					Yellowish brown, silty clays (CL) .	2.00	2.69	25		Very stiff
2.50						2.50				
3.00			3.30		Dark brown, silty clays trace cracked slates (CL).	3.00	3.98	37		Hard
3.50						3.50				
4.00						4.00	>7.00	>70		Hard
4.50					Brown, silty clays trace cracked slates (CL).	4.50				
5.00	176.428	4.80				5.00				
5.50						5.50	97	-	▽ 175.90	Very dense
6.00						6.00			(初期 -50cm 貫入)	
6.50						6.50	191	-		Very dense
7.00						7.00				
7.50			5.20		Grayish red, sandstone.	7.50	218	-		Very dense
8.00						8.00				
8.50						8.50	155	-		Very dense
9.00						9.00				
9.50						9.50	533	-		Very dense
10.00	171.228	10.00			End of drilling.	10.00				

REMARKS : N : BLOW PER 30cm (63.5Kg HAMMER 76cm DROP 5cm SAMPLER)
QU : UNCONFINED COMPRESSIVE STRENGTH (Kg / cm2)

Figure A-9 Geological Profile of Bore Hole BH 04

KEY TO STRUCTURAL CATALOGUE

Traffic classes
(10^6 esa)

T1 = < 0.3
T2 = 0.3 - 0.7
T3 = 0.7 - 1.5
T4 = 1.5 - 3.0
T5 = 3.0 - 6.0
T6 = 6.0 - 10
T7 = 10 - 17
T8 = 17 - 30

Subgrade strength classes
(CBR%)

S1 = 2
S2 = 3 , 4
S3 = 5 - 7
S4 = 8 - 14
S5 = 15 - 29
S6 = 30+

Material Definitions

- Double surface dressing
- Flexible bituminous surface
- Bituminous surface (Usually a wearing course, WC, and a basecourse, BC)
- Bituminous roadbase, RB
- Granular roadbase, GB1 - GB3
- Granular sub-base, GS
- Granular capping layer or selected subgrade fill, GC
- Cement or lime-stabilised roadbase 1, CB1
- Cement or lime-stabilised roadbase 2, CB2
- Cement or lime-stabilised sub-base, CS

CHART 1 GRANULAR ROADBASE / SURFACE DRESSING

	T1	T2	T3	T4	T5	T6	T7	T8
S1	SD 150 / 175 / 300	SD 150 / 225* / 300	SD 200 / 200 / 300	SD 200 / 250* / 300	SD 200 / 300* / 300	SD 225 / 325* / 300		
S2	SD 150 / 150 / 200	SD 150 / 200 / 200	SD 200 / 175 / 200	SD 200 / 225* / 200	SD 200 / 275* / 200	SD 225 / 300* / 200		
S3	SD 150 / 200	SD 150 / 250	SD 200 / 225	SD 200 / 275*	SD 200 / 325*	SD 225 / 350*		
S4	SD 150 / 125	SD 150 / 175	SD 200 / 150	SD 200 / 200	SD 200 / 250	SD 225 / 275		
S5	SD 150 / 100	SD 150 / 100	SD 175 / 100	SD 200 / 125	SD 225 / 150	SD 250 / 175		
S6	SD 150	SD 150	SD 175	SD 200	SD 225	SD 250		

Note: 1 * Up to 100mm of sub-base may be substituted with selected fill provided the sub-base is not reduced to less than the roadbase thickness or 200mm whichever is the greater. The substitution ratio of sub-base to selected fill is 25mm : 32mm.

2 A cement or lime-stabilised sub-base may also be used.