NO.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR BRIDGE CONSTRUCTION IN THE EAST NUSA TENGGARA(NTT) AND WEST NUSA TENGGARA(NTB) IN THE REPUBLIC OF INDONESIA

JANUARY 2005

JAPAN INTERNATIONAL COOPERATION AGENCY
GRANT AID MANAGEMENT DEPARTMENT

GM
JR
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PREFACE

In response to at the request from the Government of Indonesia, the Government of Japan decided to conduct a Basic Design Study on the Project for Bridge Construction in the East and West Nusa Tenggara in the Republic of Indonesia, and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team from July 5th, 2004 to August 18th, 2004.

The Team held discussion with the officials of the Government of Indonesia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss a draft basic design from October 28th, 2004 to November 10th, 2004. As a result of the studies, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relation between our two countries.

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

Very truly yours,

January, 2005

Seiji Kojima
Director
Japan International Cooperation Agency

January, 2005

LETTER OF TRANSMITTAL

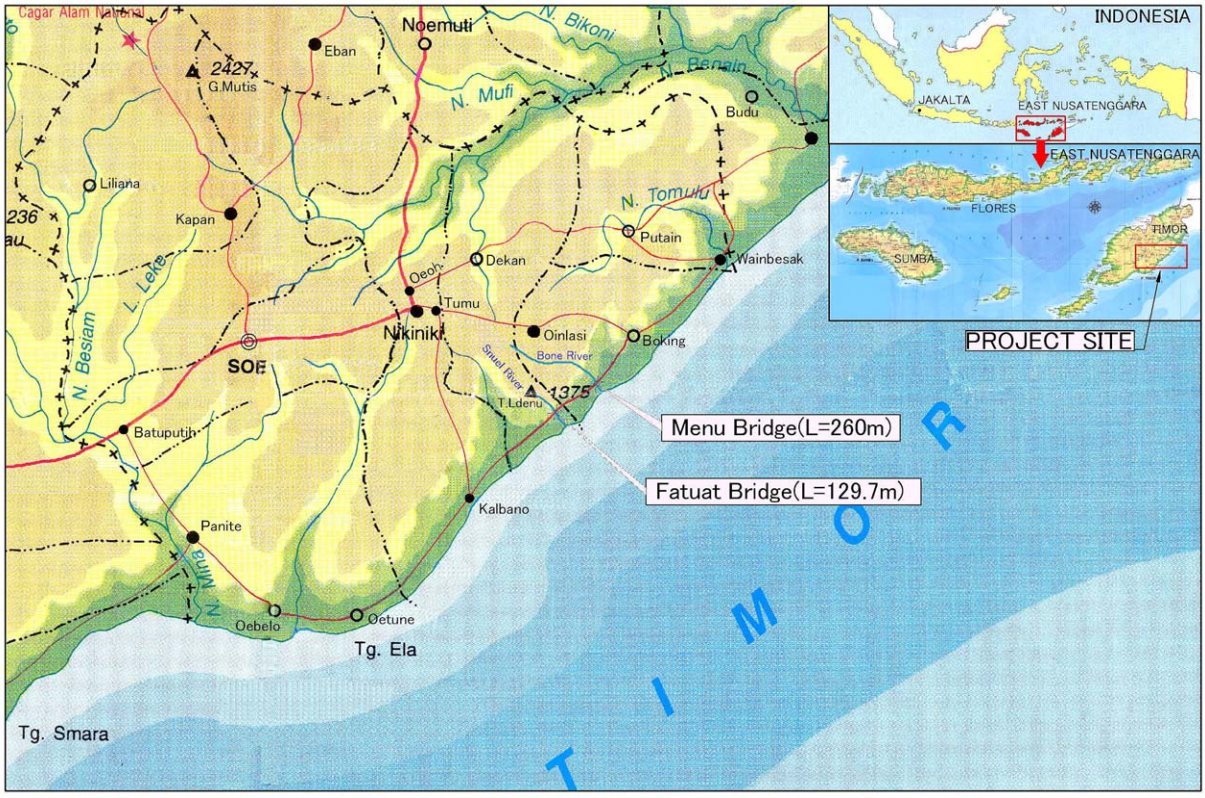
We are pleased to submit to you the basic design report on the Project for Bridge Construction in the East and West Nusa Tenggara in the Republic of Indonesia.

This study was conducted by Katrahira & Engineers International, under a contract to JICA, during the period from June 28th, 2004 to February 14th, 2005. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Indonesia, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

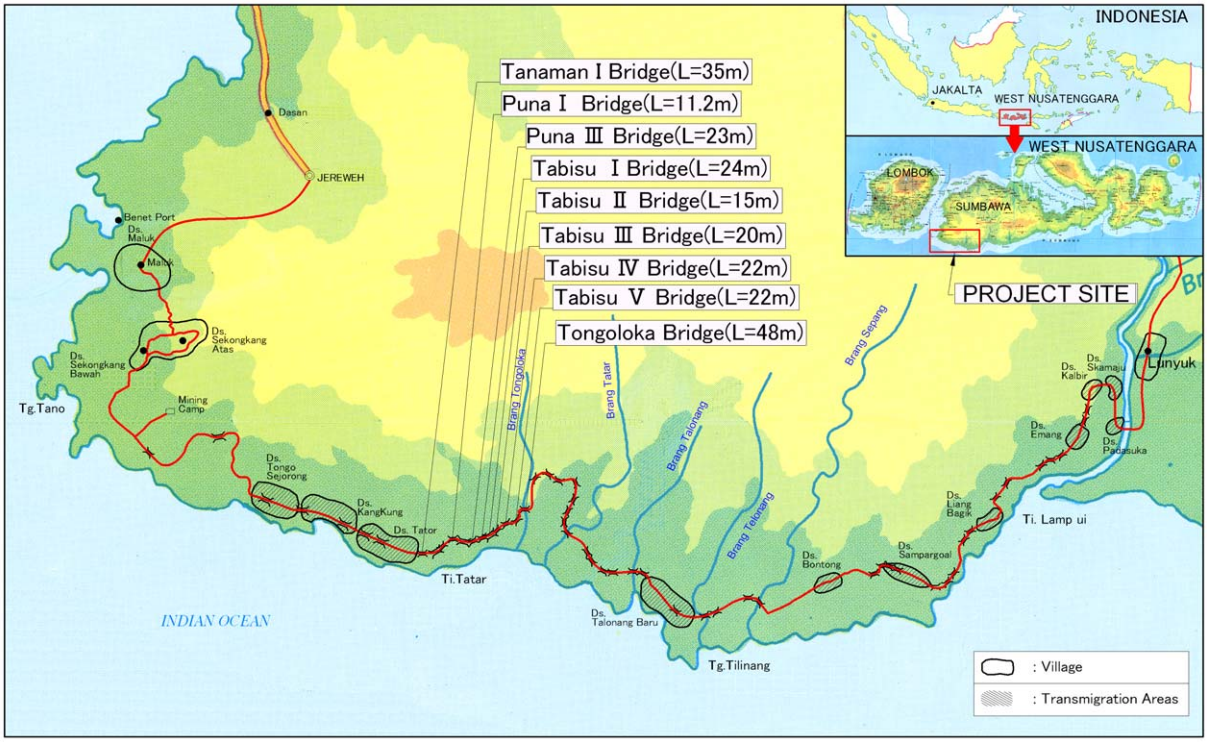
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Shingo Gose
Chief Consultant,
Basic Design Study Team on the Project for Bridge Construction in the East and West Nusa Tenggara in Indonesia.
Katahira & Engineers International



Project in NTT



Project in NTB

Location Map

① Menu Bridge（NTT）

② Fatuat　Bridge（NTT）

③ Tabisu V　Bridge（NTB）

Perspective

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Abbreviations

AASHTO	:	American Association of State Highway and Transportation Officials
ADB	:	Asian Development Bank
BAPEDALDA	:	Regional Environmental Impact Management Agency
BAPPENAS	:	National Development Planning Agency
EIA	:	Environmental Impact Assessment
EIRTP	:	Eastern Indonesian Region Transport Project
GRDP	:	Gross Regional Domestic Project
IBRD	:	International Bank for Reconstruction and Development
IEE	:	Initial Environmental Examination
JICA	:	Japan International Cooperation Agency
KSDA	:	Koaseruas Sumbawa Dan Alarm
LAPRAP	:	Land Acquisition and Resettlement Action Plan
MPW	:	Ministry of Public Works
NGO	:	Non-governmental Organization
NTB	:	Nusa Tenggara Barat
NTT	:	Nusa Tenggara Timur
PC	:	Prestressed Concrete
PROPENAS	:	Program Pembangunan National／National Development Program
RC	:	Reinforced Concrete
RENSTRA	:	Five Year Strategic Plan
Rp.	:	Indonesian Rupiah
RRSP	:	Road Rehabilitation Sector Project
TTS	:	Timor Tengah Selatan
UKL	:	Environmental Management Plan
UPL	:	Environmental Monitoring Plan

Summary

Sustainable economic growth of the Republic of Indonesia (the ROI) has been attained through the effects of the First 25-Year Long Term Plan inaugurated in 1969. The market-oriented economy policy started in the mid-198'0 has facilitated economic activities in the private sector and successfully resulted in the improvement of socio-economic development, though the ROI experienced the Asian Currency Crisis in the late 199'0.

Every 5 years, the Government of Indonesia (the GOI) formulates a National Development Plan, the aim of which is to cope with issues regarding the society, economy, education, religion and so on, and has promoted socio-economic development. Such urban areas as Java Island has enjoyed benefits and effects resulting from the implementation of the policy, however, the rural areas have received comparatively little benefits from such development. The GOI, therefore, has been addressing the above issues aiming at poverty reduction, rectification of the regional economic imbalance and the promotion of activities by private sectors through the latest 5-year Development Program (PROPENAS: 1999-2004)

Insufficiency of infrastructure for socio-economic activities in the rural areas has been regarded as a cause of the regional economic imbalance. In particular, in East and West Nusa Tenggara province (NTT and NTB), poverty and economic gaps among peoples are a serious issue. The GOI regards the poor transport facilities such as the road network which connects the isolated rural areas are deteriorated due to the inadequate maintenance and/or frequent landslide and floods in the rainy season. Moreover, the traffic paralysis in rainy season due to the lack of bridge on the roads in these areas fatally disturbs the distribution of agricultural and fisheries products. Consequently, the rural areas are more isolated and the economy in private sectors depresses more and more. The GOI, considering the above unfavorable situation, made a request for the Grant Aid to the Government of Japan (the GOJ) regarding the Bridge Construction Project in the East and West Nusa Tenggara province in October 2003. The Project requested consisted of two bridges in East Nusa Tenggara province and 8 bridges in West Nusa Tenggara province and the request was made to achieve the following purposes: to contribute to the poverty alleviation: to support to establish self-independent regional economy: to contribute to the promotion of decentralization.

In response to the request, the GOJ entrusted to the Japan International Cooperation Agency (JICA) to conduct the basic design study.

JICA sent to Indonesia the study team from July 5th, 2004 to August 18th, 2004 for the execution of the study. A mission was also dispatched to Indonesia from October 28th, 2004 to November 10th, 2004, in order to discuss a draft basic design, and got to the mutual agreement upon the draft.

The original request was to construct 10 bridges (2 bridges in East Nusa Tenggara province and 8 bridges in West Nusa Tenggara province). Since, however, as a result of field survey it revealed that, among the

eight bridges in West Nusa Tenggala province, Tanaman II bridge was completed in 2002 and Puna II bridge being under constructed would be completed in 2005, the GOI made request to include Puna III bridge and Tabis III bridge in place of those two bridges. In addition, as for Tabis II bridge completed in 2002, it was expected that the deterioration and damage on the bridge structure caused by the pile of soil on its surface would produce an ill effect on the future traffic and, therefore, a study for the improvement of the present situation was further requested by the GOI. These requests mentioned above have been included in the basic design study. There is no change in the requested bridges in East Nusa Tenggara province.

Final list of the selected bridges is as follows:

[Project Component]

(a) East Nusa Tenggara Province
Construction of Menu Bridge (260m),and Fatuat Bridge (129.7m)

(b) West Nusa Tenggara Province
Construction of following 8 bridges:
Tanaman Bridge (35m), Puna Ⅰ bridge (11.2m), PunaⅢbridge (23m), Tabis Ⅰ Bridge (24m), TabisⅢ Bridge (20m), TabisⅣBridge (220m), Tabis Ⅴ Bridge (22m), and Tongoloka Bridge (48m)

Replacement of Supper Structure of the following one bridge:
Tabis Ⅱ bridge

[Project Scale]

Shown as follows:

Bridge Name	Bridge Length (m)	Span (@ Pier Center) (m)	Superstructure Type	Abutment			Pier			Length of Approach Road (m)
				No. of Unit	Type	Foundation	No. of Unit	Type	Foundation	
NTT										
Menu	260.0	32.410 + 6×32.375 + 32.410	8-span Connected PC T Girder	2	Inverted-T	Bored Pile (Φ1.0m) A:6pile×8.0m B: Spread Foundation	7	2-column	Bored Pile (Φ1.0m) P1 : 6 pile× 8.0m P2 : 6 pile× 9.0m P3 : 6pile×10.0m P4,P5,P6,P7 : 8 pile×10.0m	614.5
Fatuat	129.7	25.850 + 3×26.000 + 25.850	5-span Connected PC I Girder	2	Inverted-T	A, B: Spread Foundation	4	Pile-bent	Bored Pile (Φ1.0m) P1,P2,P3,P4: 2 pile×20.0m	420.3
NTB										
Tanaman I	35.0	34.000	Single-span PC T Girder	2	Inverted-T	A, B: Spread Foundation	No pier			145.0
Puna I	11.2	10.000	Single-span RC Flat Slab	2	Inverted-T	A, B: Spread Foundation	No pier			88.0
Puna Ⅲ	23.0	22.000	Single-span PC I Girder	2	Inverted-T	A, B: Spread Foundation	No pier			77.0
Tabisu I	24.0	23.000	Single-span PC I Girder	2	Inverted-T	A, B: Spread Foundation	No pier			116.0
Tabisu Ⅲ	20.0	19.000	Single-span RC T Girder	2	Inverted-T	A, B: Spread Foundation	No pier			130.0
Tabisu Ⅳ	22.0	21.000	Single-span RC T Girder	2	Inverted-T	A, B: Spread Foundation	No pier			98.0
Tabisu Ⅴ	22.0	21.000	Single-span RC T Girder	2	Inverted-T	A, B: Spread Foundation	No pier			88.0
Tongoloka	48.0	2×23.650	2-span Connected PC I Girder	2	Inverted-T	A, B: Spread Foundation	1	2-column	Bored Pile (Φ1.0m) P1 : 6 pile×10.0m	147.0
Replacement of Superstructure										
Tabisu Ⅱ	15.6	15.000	Single-span RC T Girder	2	The existing substructure is used without repair .		No pier			350.0

In case of the implementation of the Project under the grant aid program of the GOJ, the Project period including detailed design and tender period is 35 months for East Nusa Tenggara province and 32 months for West Nusa Tenggara Province. The overall Project costs wll be 1.742 billion yen, in which the amount of grant aid will be 1.736 Billion Yen (0.945 Billion Yen for East Nusa Tenggara and 0.791 Billion Yen for West Nusa Tenggara) and the amount forn by the GOI will be 6 Million Yen.

The government agency in charge of the Project is the Ministry of Public Works (the MPW), and the executing agency is the Department of Eastern Regional Infrastructure of the MPW. For the MPW has many experiences of road and bridge construction projects mainly under the foreign loan, no particular issue is visible in project management. The infrastructure division of the concerned provincial office is in charge of the maintenance of those after the completion of the Project. Both of East and West Nusa Tenggara provinces have operation and maintenance divisions for road and bridge, with staff of 14 and 34 personnel in East and West Nusa Tenggara Provinces respectively, and enjoy decent allocation of budget for those maintenance, because of this, it is reasonable to judge that the competent regional offices of both provinces are capable of maintaining the Project components after the completion of the Project.

The direct effects of the Project are 1.76 Million populations, 1.3 Million in East Nusa Tenggara Province and 0.46 Million in West Nusa Tenggara Province.

The following effects are expected through the implementation of the Project.

(1) Direct Effects

(a) Improvement of Traffic Function

- Traffic function as an arterial road will be improved by securing the year-round traffic through elimination of impassable sections and periods during the rainy season.

(b) Shortening of Traveling Time

- Traveling time between major cities or villages will be significantly shortened by constructing bridges crossing over the rivers that have been difficult to cross over.
- Smooth and comfortable driving at river crossing can be expected.

(c) Efficiency of Cargo Transportation

- Efficiency of cargo transportation can be expected through construction of the proposed bridges and access roads with smooth alignment at river crossing where it has been extremely difficult for cargo tracks to cross over.

(2) Indirect Effects

(a) Promotion of Distribution of Goods and Communication of People

- Through the improved traffic function as an arterial road, the following effects can be expected: smooth distribution of goods such as agricultural, fishery and stock farm products

will be secured: communication of people and transmigration plan will be promoted.

(b) Revitalization in Social and Regional Economic Activities

- Revitalization of social and regional economic activities will result from the improvement of living conditions through promotion of distribution of goods and communication of people.

For the implementation of the Project is expected to provide with the significant benefits to the residents along the Project road as mentioned above, and at the same time, to contribute to upgarde living standard of the residents and to promote social and economic development in the Project area and its vicinity, it is reasonable to conclude that the Project is suitable to implement under the grant aid program of the GOJ. Due requirement to the GOI, to realize the Project, is that the GOI is to perform land acquisition in time and compensate the land owners with a reasonable manner. In addition, for West Nusa Tenggare province, it is the key requirement to improve and maintain the condition of the south ring road including untying the blockage of the road according to the schedule mutually agreed upon in the basic design study stage.

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[Appendices]

Chapter 1 Background of the Project

The Government of Indonesia (hereinafter referred to as "the GOI") has been addressing to reduce the poverty through narrowing the economic gap between regions, which is a major issue in the National Development Plan. The Eastern Region, particularly, is one of the most important areas to be addressed in the plan. The East Nusa Tenggara (Nusa Tenggara Timor; hereinafter referred to as " NTT") and the West Nusa Tenggara (Nusa Tenggara Barat; hereinafter referred to as " NTB") are located in the easternmost part and situated in the least less-developed regions in Indonesia with per capita Gross Regional Domestic Products (GRDP) being a half to one-third of the average of the nation.

NTT governs the western part of Timor Island, eastern part of which is the East Timor. The national road is the only arterial road composing the central corridor distributing goods through feeder roads in NTT. However, landslides often occurring every rainy season within the corridor in the mountainous area prevent smooth distribution of goods. The requested two (2) bridges are located on the provincial road 129 being developed as an arterial road along sea side, which composes the southern corridor. With the completion of these two bridges, the provincial road will be connected between main cities or villages such as Wainbesack, Boking, Kalbano, Panite, etc. divided by major rivers. This will accelerate the development of the whole southern corridor which is expected to be an alternative corridor to the central one. Though the GOI has been developing the provincial road, the construction of the two bridges has been critical due to the lack of fund and construction difficulties.

The requested nine (9) bridges in NTB are located on the western portion of the south ring road connecting Sejorong and Lunyuk in Sunbawa Island. The GOI has been developing the abutting areas along the ring road for transmigration. The agricultural and industrial goods are now transported using the national road going through the northern part of the island. The south ring road, the length of which is about 80km, is being developed as an alternative arterial road to the national road. The ring road once was constructed in 2002, but its function as a ring road is insufficient because that there are some impassable portions during the rainy season due to lack of bridges and that sections in mountainous area are impassable through the year due to landslides and scouring at rivers without bridges. Though the GOI have a plan to restore and improve the ring road, the schedule of the development is not yet fixed due to lack of fund and

construction difficulties as well as NTT.

All bridges requested by the GOI as mentioned above are located on the arterial roads being developed in line with the strategic policy of the National Development Plan. This Project is expected to be direct benefit for the regions being left behind the social and economic development through the bridge construction in cooperation with the improvement of road sections by the GOI, consequently contributing to the poverty reduction in those areas.

Table 1.2-1 shows the study bridges finally requested by the GOI.

Table 1.2-1 Outline of the Project

Region	Initial Request	Final Request	
NTT	Menu Bridge, Fatuat Bridge; (Construction of 2 Bridges)	Menu Bridge, Fatuat Bridge; (Construction of 2 Bridges)	No change
NTB	Tanaman I Bridge, **Tanaman II Bridge**, Puna I Bridge, **Puna II Bridge**, Tabisu I Bridge, Tabisu III Bridge, Tabisu V Bridge, Tongoloka Bridge; (Construction of 8 Bridges)	Tanaman I Bridge, Puna I Bridge, **Puna III Bridge**, Tabisu I Bridge, Tabisu III Bridge, **Tabisu IV Bridge**, Tabisu V Bridge, Tongoloka Bridge; (Construction of 8 Bridges) **Tabisu II Bridge** ; (Improvement)	Tabisu II Bridge is for the improvement of the existing bridge, the other two bridges are exchanged; because Tanaman II Bridge was already constructed, Puna II Bridge is being under construction.

Chapter 2 Contents of the Project

2.1 Basic Concept of the Project

2.1.1 Overall Goal and Project Purpose

The Government of Indonesia (GOI) has formulated the following five (5) objectives in the national development plan (PROPENAS: 2000-2004).

- Establishment of democratic government system and maintenance of national unity and solidarity,
- Establishment of good governance,
- Promotion of economic recovery and reinforcement of sustainable and equitable development infrastructure,
- Enhancement of social welfare, qualitative improvement of religious life and creation of vigorous culture, and
- Promotion of rural development.

In the "Promotion of rural development" above, to facilitate the development and maintenance of the road transportation facilities, particularly establishment of road network, is given the high priority in order to enhance social and economic activities.

In line with the policy of the national development plan, the Ministry of Settlement and Regional Infrastructure (MSRI) has formulated the following six (6) strategies (RENSTRA: 2001-2004) for road development.

- Stabilization of road function through proper rehabilitation and maintenance,
- Completion of important road rings to effectively operate the road network system,
- Rectification of imbalance of road network,,
- Study on alternative expenditure for road restoration,
- Promotion of privatization in road construction and maintenance, and
- Continuation of toll road operation.

The Project for Bridge Construction in the East Nusa Tenggara (NTT) and West Nusa Tenggara (NTB), considering that the Project will be conducive to the objectives of the national development plan and the development strategies of MSRI, is to be implemented in response to the request made by the GOI.

The overall goal and project purpose are as follows:

- Overall Goal; to strengthen the road transportation capability and to facilitate social and economic development, and to stabilize people's livelihood in the project areas.
- Project Purpose; to secure year-round safe and smooth traffic in the project areas.

2.1.2 Basic Concept of the Project

The Project is to construct or improve the bridges to achieve the above goal and purpose: construction of two (2) bridges (Menu Bridge, Fatuat Bridge) in NTT; construction of eight (8) bridges (Tanaman I Bridge, Puna I Bridge, Puna III Bridge, Tabisu I Bridge, Tabisu III, Tabisu IV Bridge, Tabisu V Bridge, Tongoloka Bridge) and improvement of one (1) bridge (Tabisu II Bridge) in NTB.

2.2 Basic Design of the Requested Japanese Assistance

2.2.1 Design Policy

2.2.1.1 Scope of the Japanese Assistance

The initial request from the GOI was to construct ten (10) bridges (two (2) bridges in NTT and eight (8) bridges in NTB). However, as it was found during site survey that among initially requested bridges in NTB, Tanaman II Bridge was already constructed in 2002 and Puna II Bridge is now being under construction, to be completed in 2005, in exchange for the construction of these two (2) bridges, Puna III Bridge and Tabisu IV Bridge were requested for construction. Tabisu II Bridge which was constructed in 2002 was also included in the Project in case that the bride might be damaged or deteriorated because it has been covered with soil. There is no change in the bridge construction requested in NTT. The following bridges, accordingly, were finally included in the components of the Project.

- NTT: construction of two (2) bridges(Menue Bridge, Fatuat Bridge)
- NTB: construction of eight (8) bridges (Tanaman I Bridge, Puna I Bridge, Puna III Bridge, Tabisu I Bridge, Tabisu III Bridge, Tabisu IV Bridge, Tabisu V, Tongoloka Bridge) and improvement of one (1) bridge (Tabisu II Bridge)

2.2.1.2 Grade of Bridge

The bridges are to be constructed on the provincial roads; accordingly B type without side walks (road width: 6.0m) is to be applied to the bridges in the Project, which type is commonly applied to provincial roads in Indonesia.

2.2.1.3 Consideration for Natural Conditions

Natural conditions are utilized for the following design items:

Meteorological Condition; construction planning, estimation of flow rate/volume and local scouring depth of each river during flood,

River Condition; the necessity of river bank protection and its scale, estimation of local scouring depth, planning of the location of abutments, the height and length of the bridges, and construction planning,

Topographical and Geographical Conditions; planning of bridge locations and bridge length, estimation of bearing layer and resistance of foundation,

selection of foundation type, construction planning,

Earthquakes; selection of bridge type, determination of the scale of substructures and foundations.

As far as design high water level (HWL) is concerned, the past highest water level from interview survey or traces of flood at sites is applied to it due to lack of precipitation data in the exact project areas. The vertical clearance between the bridge soffit and the design high water level is to be set in compliance with the bridge design guide lines in Indonesia, while the minimum span length of a multi-span bridge is to be determined referring to the Structural Standards for River Management Facilities in Japan.

(1) Precipitation

NTT

Annual rainfall is about 1,900 mm, and the period of rainy season is about four (4) months from December to March.

NTB

Annual rainfall is about 1,400 mm, and the period of rainy season is about four (4) months from December to March.

(2) River Condition

NTT

Menu Bridge and Fatuat Bridge are to be located at near the mouths of the Bone River (catchment area: 124km2, river length: 32km, gradient: 2% up to 3km from the river mouth, 6% at an average subsequently) and the Snuel River (catchment area: 60km^2, river length: 9km, gradient: 6% on average), respectively. Both rivers are estimated to have the similar rainfall pattern, considering that both of them have the catchment areas in around Oinlasi in Nunkolo district. Rocks and stones caused by landslide from steep tributary rivers have been carried into the both rivers, settling to the riverbeds around the bridge sites. The geological strata at the river banks of both rivers consist of alternation of strata with cobbles and sandy soil, which suggests that those river channels have changed frequently within limited area of riverbed. The conditions of the rivers at the proposed bridge locations are described in Table 2.2.1-1, with the estimation of scouring only for the bridge having a pier:

Table 2.2.1-1 Characteristics of the Rivers (NTT)

Name of Bridge	Characteristics
Menu Bridge (Ref. Figure 2.2.1-1)	・Observed thick deposit of boulders and cobbles. During the flood of 50-year return period, the flow rate is estimated to be 4.4 m/s, souring depth be 2.0m, and traction capability be 30cm size of coble. Difficult to access by car in a rainy season. ・Observed many coconut drifts, with the size of ϕ 0.8m x 8m long. ・Erosion is observed upstream on both sides of the river, approx. 100~200m long each. The latest flood happened in May 2004, eroded the right side of river bank by 5m thick for about 100m long, adjacent to the present access road
Fatuat Bridge (Ref. Figure 2.2.1-2)	・Observed thick deposit of boulders and Cobles. During the flood of 50-year return period is estimated to be 5.0 m/s, souring depth be 1.9m and traction capability be 30cm size of coble. ・Observed some coconut drifts, with the size of ϕ 0.5m x 15m long. ・Erosion is observed full stretch upstream on both sides of the river, except the point of 100m upstream on the left side. ・The water level computed upon a basis of 50-year return period is shallow as 1.5m. This might be coincident with the comment of residents that one can cross the river on foot at the time of small flood

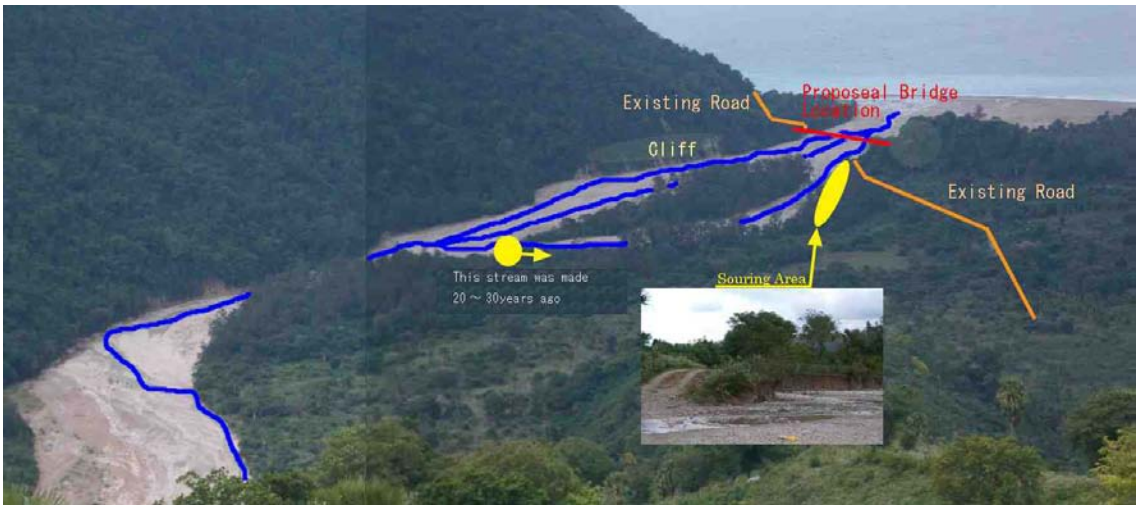


Figure 2.2.1-1 Flow Regime at the Proposed Menu Bridge Site

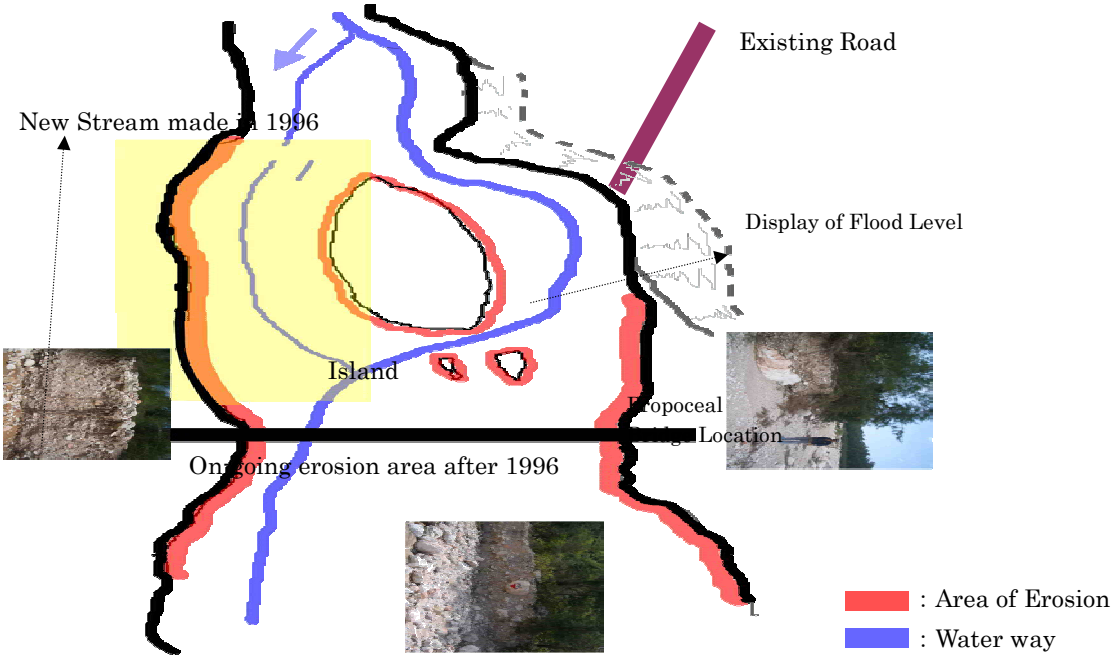


Figure 2.2.1-2 Flow Regime at the Proposed Fatuat Bridge Site

NTB

All proposed bridges are located near the sea, and those catchment areas are small except Tongoloka, as described in Table 2.2.1-2.

Table 2.2.1-2 Characteristics of the Rivers (NTB)

Name of Bridge	Characteristics
Tanaman I Bridge	・Small flow is observed in dry season. The flow rate at the flood of 50-year return period is estimated to be 2.5 m/s. ・Observed cobbles of 2~8cm in size deposited.
Puna I Bridge	・No flow in dry season. Observed cobbles of 30cm in size in the riverbed. ・The flow rate at the flood of 50-year return period is estimated to be 2.0 m/s.
Puna III Bridge	・No flow in dry season. Observed no cobbles in the riverbed. ・The flow rate at the flood of 50-year return period is estimated to be 1.5 m/s.
Tabisu I Bridge	・Cross the Ganuhang River. No flow in dry season. ・Observed cobbles of 20cm in size deposited in the riverbed ・The flow rate at the flood of 50-year return period is estimated to be 2.0 m/s.
Tabisu II Bridge (Existing Br.)	・Cross the Batulanteh River. No flow in dry season. Observed cobbles of 20cm in size in the riverbed. ・The flow rate at the flood of 50-year return period is estimated to be 2.1 m/s.
Tabisu III Bridge	・No flow in dry season. Observed no cobbles in the riverbed. ・The flow rate at the flood of 50-year return period is estimated to be 1.0 m/s.
Tabisu IV Bridge	・No flow in dry season. Observed no cobbles in the riverbed. ・The flow rate at the flood of 50-year return period estimated to be 2.0 m/s.
Tabisu V Bridge	・No flow in dry season. Observed no cobbles in the riverbed. ・The flow rate at the flood of 50 years return period is estimated to be 2.3 m/s.
Tongoloka Bridge	・Cross the Tongoloka River. Observed the water to be 20cm deep and 6.0m wide in dry season, rubbles and cobbles of 40cm in size deposited, and coconut drifts of ϕ 50cm x 10m long in size, in the riverbed. ・During the flood of 50-year return period, the flow rate is estimated to be 4.5 m/s and the scouring depth be 2.0 m.

It is only for limited hours for vehicles unable to cross the rivers at the proposed bridge locations during the flood, except the Puna II and Tongoloka rivers, according to the interview survey.

(3) Topography of the Project Sites

NTT

Topography of the left side of Menu Bridge, which is to be located at abut 300 m from the river mouth, is the mountain area with steep cliff, while that of the right side is relatively flat and gently climbs up toward the mountain area. The low and small mountain consisting of rocks at near the right side abutment of the bridge can be expected as a protection from hydraulic erosion in the bridge planning.

Fatuat Bridge is to be located at about 1.0 km from the river mouth; gradient between the bridge location and the river mouth is relatively flat; the river bed is very shallow at about 2.0m high.

NTB

All the bridge sites in NTB are to be located along the craggy coast which has been eroded by ocean waves. The rivers have no name other than the rivers which Tabisu I Bridge, Tabisu II Bridge and Tongoloka Bridge cross over. The rivers having no name, which are small streams, have been generated through scouring and erosion caused by water flow coming from small and steep catchment areas.

(4) Geography of the Project Sites

Outline of the geography at each project site is described in Table 2.2.1-3. Judging from the geographic survey, to apply spread foundation for the abutments of bridges is to be economical. As far as the foundations for piers of Menu Bridge, Fatuat Bridge in NTT and Tongoloka Bridge in NTB are concerned, pile foundations are to be applied in terms of construction difficulty and economical efficiency, considering that the bearing strata at the location of piers to be constructed lie at 13m to 18m in depth from river beds.

Table 2.2.1-3 Geographic Features at Bridge Sites

	Bridge Name	Borehole location	Outline of Geographical Features			
			Surface Layer		Bearing Layer (N-Value: 50 or more for Sand or Gravel, 20 or more for Clay)	
			Soil	N -Value	Depth (m)	Soil
NTT	Menu Br.	Left Side	-	-	1.5	Gravel with cobles
		Right Side	Silty clay	2 - 8	5.5	Gravel with cobles
		River Center	Silty gravel with cobles	20 - 60	18.0	Gravel with cobles
	Fatuat Br.	Left Side	Silty gravel	30 - 40	3.5	Gravel with cobles
		Right Side	Silty gravel	24 - 35	4.5	Gravel with cobles
		River Center	gravel	20 - 45	18.0	Gravel with cobles
NTB	Tanaman I Br.	Right Side	-	-	1.0	Gravel
	Puna I Br.	Right Side	-	-	1.0	Gravel with cobles
	Puna Ⅲ Br.	Right Side	-	-	1.0*	Gravel
	Tabisu I Br.	Right Side	Silt with cobles	40	4.0	Gravel with cobles
	Tabisu Ⅲ Br.	Right Side	Silty clay with gravel	34	2.0	Gravel with cobles
	Tabisu Ⅳ Br.	Right Side	-	-	1.0*	Gravel
	Tabisu V Br.	Left Side	-	-	1.0	Silty clay with gravel
	Tongoloka Br.	Left Side	-	-	1.0**	Gravel with cobles
		River Center	Gravel with cobles	28 - 60	13.0	Gravel with cobles

* : Determined from visual survey referring data of abutting boreholes.
** : Determined from visual survey by excavating approximately 2.0m in depth.

(5) Earthquakes

The scale of an earthquake specified in the design guide lines in Indonesia is applied for bridge design considering a regional factor.

2.2.1.4 Design Guide Lines to be Applied and Design Requirements

(1) Design Guide Lines to be Applied

Design Guide Lines in Indonesia are principally applied, however, for the parts which are not specified in it, AASHTO and specification in Japan are applied.

Bridge Design

- Bridge Management System(BSM) (Indonesia)
- Bridge Design Manual (Indonesia)
- Standard Specification for Highway Bridges (AASHTO, 2002)
- Specifications for Highway Bridges (Japan Road Association, 2002)

Highway Design(Approach Roads)

- Tata Cara Perencanaan Geometrik Jaran Antar Kata (Indonesia)
- A Policy on Geometric Design of Highways and Street (AASHTO, 2001)
- Interpretation and Practice on the Regulation of Road Structures (Japan Road Association, 2004)

(2) Design Requirements

Bridges

i) Standard Cross Section

- Road Width: Type B without side walks is applied, being commonly used for the provincial roads.

ii) Design Loads

- Live Load: MS 18 (HS 20-44)
- Regional Seismic Factor: 0.18
- Changing Range of Temperature for Thermal Load: 15 to 40 degrees for concrete girders

iii) Material Properties

- Concrete Structure
  - PC Girder : 40 Mpa
  - RC Deck Slab : 25 Mpa
  - Abutment and Pier : 25 Mpa
  - Bored Pile : 30 Mpa
- Reinforcement Bar: SD 345 (Japanese Industrial Standard) or equivalent

iv) Design High Water Level

The design high water level is set at the past highest water level estimated based on interview survey at sites, and verified or complemented by the hydrological analysis with 50-year return period.

v) Freeboard

Minimum freeboard is adopted 1.5m in height.

Approach Roads

- Design Speed : 50 km/h
- Maximum Vertical Gradient: 10% (less than 16% in special case)

- Road Width : 7.0 m
- Pavement: Asphalt Penetration Macadam for ; 50m long from abutment on both sides, and only for Tabisu II Br., 200m long at beginning side & 150m long at end side
  Gravel : remaining section

2.2.1.5 Environmental and Social Considerations

The proposed bridges being located on mountainous and agricultural areas, the Project does not give rise to relocation of housing or communities. However, as the approach roads or access roads to the existing roads for Menu Bridge and Fatuat Bridge go through agricultural areas, the negative impacts on those areas by the Project are planned to be minimized.

As for natural environment considerations, cutting portions will be minimized as much as possible in planning and design; water pollution due to construction works will also be minimized by applying proper construction method and management; waste materials generated by construction are to be properly disposed.

The negative impacts on natural and social environments is estimated to be minor or negligible according to environmental examination at Initial Environmental Examination (IEE) level which was conducted in cooperation with Indonesian side. BAPEDALDA has issued the approval for the implementation of the Project to the responsible agency. The agency responsible for the Project has to monitor the environmental impacts associated with the implementation of the Project based on UKL and UPL prepared y the agency. Monitoring of the environmental impact is required for bridges longer than 60m; Fatuat Bridge and Menu Bridge in NTT.

Public consultation meetings with stakeholders were held by Indonesian side for smooth implementation of the Project. Main opinions in the consultations, which are summarized in Table 2.2.1-4, are in favor of the Project as the design was planned so as not to give wise to major negative impacts such as involuntary resettlement.
As for acquisition of private lots affected by the Project, there were no objections to it from stakeholders with expecting the development and benefits of villages, especially, landowner of area where Fatuat Bridge is to be constructed agreed upon to provide land for the Project.

Table 2.2.1-4 Main Opinions

	Main Opinions
NTT	**No.1,** Date: July 15, Venue: Nunkolo Village, Host: BAPEDALDA & KIMPRASWIL, Participant: Residents (50) ・To preserve the sacred mountain. ・Bridge construction is welcomed. ・Please make our future by constructing the bridges.
	No.2, Date: July 15, Venue: Nualunat Village, Host: BAPEDALDA & KIMPRASWIL, Participant: Residents (100) ・About 10,000 people will benefit from the bridge construction. This area is divided and isolated by rugged topographical features. The problem with this area is poor transportation for agricultural products due to poor roads and no bridges, while this area has a high potential of agricultural products. If the bridges are constructed, drinking water would also be transported because the quality of well water is not good. The issue of R.O.W acquisition is no problem since the land owner whose land covers entire the project area participates in this meeting. There is now a plan to develop oil resource; the bridges will be utilized to transport it. ・There is a plan to grade up the provincial road to the national road, which connects relatively big towns along south-east coast. This southern provincial road has more important role for transportation than roads crossing mountain areas.
	No.3, Date: July 17, Venue: District Office of TTS, Host: Governor of TTS Participant: Officials of Province, District, Sub-district and NGO (20) ・The culture of the Dawan tribes in the area needs to be analyzed more. ・Thank Japan for giving the people better access. Be careful about landslide and erosion caused by intensive rainfall. ・Disposal soil generated by construction shall be considered so as to be utilized for agriculture, as fertile soil has settled around the project area. ・Outside workers need to be guaranteed to be free from AIDS or will not spread AIDS to the local area. ・The sides of the river are ruined because of farming. The regulation has stated that farming area must be 50m away from the edge of the river. ・Local conflict of interest is anticipated because of the sort period of consultation. ・It will be guaranteed that there is no conflict of interest among the people. ・As the project site is distant from resident areas, the positive social impacts could be fully expected. Erosion is the most concerned. The south road is important for transportation of oil. ・Mountain in Boking consisting of rocks is hardly eroded. Protecting roads and forests from erosion or damage is the responsibility of the local government, not Japan side. ・For the governor, after development of the new road including bridge construction, the housing of the people shall be relocated closer to the new road so that they can utilize the road to receive better access to public services. ・Even though West Timor is said to be in a level 5 security warning by the United Nation, it is a safe area. Activities for foreign assistance will not be hampered. ・Boking port is damaged due to wave damage to the pillar. It will be fixed after completion of the southern provincial road. The port will be a supply base for oil.
NTB	Date: July 26, Venue: District Office of West Sunbawa, Host: Goveror of Sunbawa District Participant: Government Officials, Representative of resident and NGO (120) ・Bridge construction is fully welcomed. ・Many bridges are needed for this area. Local labors, materials and equipment are expected to be hired or utilized as many as possible during the construction work. ・Issues of bridge construction are quality rather than quantity. The bridges constructed by local contractors are easily damaged because of those poor qualities. ・There is the list of rare birds, preservation of which shall be considered. (It was confirmed that the impact by the project is less because the deforestation by the construction is less and limited around bridge locations.)Preservation of water resources shall be considered as well. ・The most important thing is improvement of road, but bridge construction. ・This project will bring a huge benefit to the local with small cost. We will fully support the project.

2.2.1.6 Participation of Local Construction Companies and Engineers/Workers

Some local contractors in the project area have improved construction skills through piling up experience in large scale construction projects as sub-contractors of major contractors in Jakarta or foreign contractors. However, having experience of the reinforeced concrete T type bridge (RC-T) construction but construction of prestressed concrete (PC) girder bridges and cast-in-place concrete piles, they will not be expected as sub contractors for the Project. Hence, the Project is to be implemented with contractors appropriate for the Project in Jakarta under the instruction of Japanese engineers.

In due consideration of above present situation, simple structures and construction method easy for quality control and safety control are to be so applied as much as possible that local contractors/personnel can participate in the procurement of labors, lease of equipment, sub-subcontracting work and so on.

2.2.1.7 Consideration on Implementing Agencies' Ability in Maintenance

The maintenance of provincial roads is, in principle, will be implemented through local contractors by provincial government where the project bridges are located. Considering the skill level of local contractors and the scale of budget of provincial government, structures both easy and requiring low cost for maintenance are to be applied.

2.2.1.8 Policy in Preparation of Construction Plan

Though the project bridges are all close to seaside, it is difficult to access to the project sites from seaside because of existence of cliff in NTB and wild waves in NTT, conditions of which are not fit for berthing. Construction materials and equipment are, therefore, to be transported from nearby ports to the project sites by road. The road conditions both in NTT and NTB have partially very poor geometry and bad surface conditions. The capacity of hauling route from ports to the project sites, which is indicated below, is a major point in the construction planning, accordingly.

- Vehicle for Hauling : Trucks with the deadweight of 10 tons
- Crane Truck : Rafter crane with 45t lift
- Equipment for Foundation Work : Backhoe of crawler mounting type with a capacity of 0.8m^3

- Maximum length of equipment or material : 6～7 m

Foundation work will be undertaken during dry season considering the water level.

2.2.1.9 Policy in Selection of Bridge Type

The most appropriate type is selected in consideration of various factors including economical efficiency, constructability, maintenance difficulty, environmental impacts, geometrical alignment and durability.

- Economical Efficiency : To be constructed with low cost for the Project to be cost-effective.
- Construction Difficulty : To be constructed easily and safely.
- Maintenance Difficulty : To be easily maintained with low cost. Concrete material is preferable for superstructure from this point of view.
- Environmental Impact: To select construction method so as to minimize the impact on natural environment, since there is no housing in the vicinity of the project sites.
- Durability : To be durable enough, particularly for river bank and riverbed protection which prone to be easily damaged.

2.2.1.10 Construction Period and Packaging

Implementation schedule is formulated as follows, considering that confirmation of the completion of Puna II Bridge and budgetary preparation for the road development between Tongoloka and Lunyuk in NTB is needed.

- NTT (2 bridges): Phase I (4 fiscal years in Japan)
- NTB (9 bridges): Phase II (3 fiscal years in Japan)

Implementation period is estimated as follows:

- Detailed Design : 3 months for both provinces
- Preparation for Bidding : 3 months (tender documents, PQ, advertisement, bidding, contract with a contractor)
- Construction : 30 months for NTT, 26 months for NTB

2.2.2 Basic Plan

2.2.2.1 Design High Water Level and Vertical Clearance

Design high water levels are determined based on the interview survey of maximum flood level since the analyzed water levels are inaccurate due to the insufficiency of rainfall data for each catchment area and the difficulty of establishing accurate hydrological boundary conditions.

The quantity and velocity of design discharges are estimated using the rational formula with rainfall intensity of 50-year return period, which is commonly used for the design high water level in Indonesia, and hydrological conditions which coincide with the high water levels by interview survey.

The rainfall intensity of 50-year return period is estimated based on the rainfall data at Oinlasi (NTT) and Lunyuk (NTB) weather stations, which are nearest to the bridge sites.

The design high water levels, quantities and velocities of design discharges at the bridge sites are shown in Table 2.2.2-1. The freeboard is set at 1.5m, which is commonly adopted for bridges at mountainous or hilly sites in Indonesia.

Table 2.2.2-1 Design High Water Level and Discharge

	Catch-ment Area (km^2)	50-years Rainfall Intensity (mm/h)	Velo-city (m/s)	Quantity of Design Discharge (m^3/s)	River Cross Section Area (m^2)	Maximum Flood Level (Design HWL)	50-year Flood Level (Analyzed)	Free-board (m)	Girder Bottom EL
NTT									
Menu	124.0	319.0	4.4	2,201	508.4	20.5	20.4	1.5	22.0
Fatuat	60.0		5.0	1,200	156.9	17.6	17.6		19.1
NTB									
TanamanI	13.9	215.5	2.5	209	38.9	19.5	19.4	1.5	21.0
Puna I	4.0		2.0	65	17.2	17.8	17.3		19.3
Puna Ⅲ	4.0		1.5	65	18.5	19.5	17.3		21.0
Tabisu I	3.0		2.0	49	12.4	19.9	17.5		21.4
Tabisu Ⅲ	3.0		1.0	49	19.7	16.6	16.3		18.1
Tabisu Ⅳ	3.0		2.0	49	11.5	18.8	18.1		20.3
Tabisu V	7.0		2.3	114	23.1	16.1	14.4		17.6
Tongoloka	59.5		4.5	686	105.4	18.1	18.1		19.6

Note: Elevations are based on temporary bench marks installed by the Study Team.

2.2.2.2 Bridge Planning and Design

(1) Design Concept

1) Bridge Locations

The locations of bridges are proposed based on the technical viability components, which include conditions of the existing road alignment, topography, river, presence of obstacles such as houses, securing of detour during construction and so on. The final locations are decided upon coordination with concerned officials of Indonesia side.

2) Abutment Locations

Abutments are proposed at locations that satisfy the following conditions:

① Abutments should be placed directly behind the intersection points of the river cross-sections and the high water level (HWL). The river cross-sections under the bridges are assumed based on the natural river sections at the upstream and downstream sides of the bridge.

② The bridge approach roads should be connected to existing roads with smooth alignments.

③ Bridges should not obstruct flood discharges.

④ Construction should not disrupt public traffic.

3) Bridge Lengths

The bridge lengths are determined taking into consideration the above abutment requirements, approach road alignments and the corresponding costs.

4) Minimum Span Lengths

In the determination of span lengths for multi-span bridges, the required minimum span specification in the "Japanese River Structure Specification" is considered. The minimum span length is derived using the following formula.

$$L = 20 + 0.005 \times Q$$

Where, L : Minimum span length (m)

Q : Design discharge (m^3/s)

5) Minimum overburden for Pier Footings

Minimum overburden for pier footings set at 2.0m in thickness considering with spot scouring. Because the estimation of depth of scouring by Ishizaki Method, which are calculated approximately 2.0m at Menu Br., 1.9m at Fatuat Br. and 2.0m at

Tongoloka Br., shows un-necessity the scour protection if overburden of 2.0m in thickness is secured.

6) Bridge Elevations

Bridge elevations are set at the height of design high water level plus freeboard and bridge depth. Menu and Tanaman I bridges are sloped to connect with the steep approach roads.

7) Bridge Structures

For the multi-span bridges, a connected girder type structure is proposed considering its structural resistance to earthquakes, the convenience for passing vehicles and the minimal maintenance requirement.

(2) Superstructure

The superstructure type selected for each of the bridge is summarized in Table 2.2.2-2. In the selection of the superstructure type, the bridges are segregated into two groups: those with spans less than 22 m and those with spans over 22 m. The superstructure types applicable for the each group are compared in terms of cost, constructability and maintenance requirement as shown in Table 2.2.2-3 (1) and (2).

Table 2.2.2-2 Selected Superstructure Type

Bridge Name	Requested Bridge Length (m)	Minimum Span (Required) (m)	Proposed Bridge Dimension (m)			Selected Superstructure Type
			Bridge Length	Span (@ pier center)	Bridge Depth	
NTT						
Menu	250.0	31.0	260.0	32.410+6@32.530 +32.410	1.935	8-span Connected PC-T Girder
Fatuat	160.0	26.0	129.7	25.850+3@26.000 +25.850	1.814	5-span Connected PC-I Girder
NTB						
Tanaman I	60.0	------	35.0	1@34.000	2.015	PC-T Girder
Puna I	20.0	------	11.2	1@10.000	0.700	RC Flat Slab
Puna Ⅲ	15.0	------	23.0	1@22.000	1.794	PC-I Girder
Tabisu I	25.0	------	24.0	1@23.000	1.794	PC-I Girder
Tabisu Ⅲ	25.0	------	20.0	1@19.000	1.577	RC-T Girder
Tabisu Ⅳ	15.0	------	22.0	1@21.000	1.677	RC-T Girder
Tabisu V	20.0	------	22.0	1@21.000	1.677	RC-T Girder
Tongoloka	60.0	23.5	48.0	2@23.650	1.794	2-span Connected PC-I Girder

Table 2.2.2-3 (1) Comparison of Superstructure Type (Span less than 22 m)

Bridge Name		Bridge Dimension			Comparative Superstructure Type		
		Bridge Length	Span	Min. Span	Scheme-1 PC Girder	Scheme-2 Steel Plate Girder	Scheme-3 RC Girder
NTB	Puna I	11.2 m	1@10.000 m	--------	Single-span PC I Girder (Composite Type)	Single-span Steel Plate Girder (Non-composite Type)	RC Flat Slab
	Tabisu Ⅲ	20.0 m	1@19.000 m	--------			RC-T Girder
	Tabisu Ⅳ・Ⅴ	22.0 m	1@21.000 m	--------			

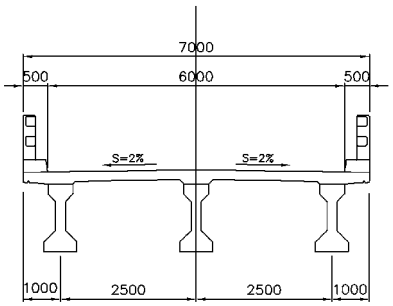
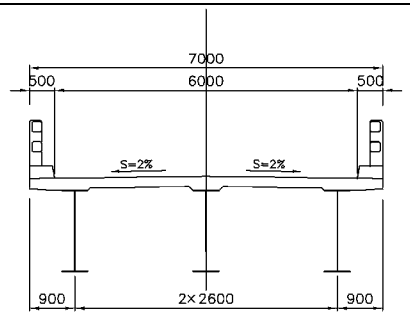
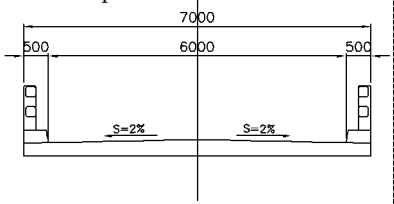
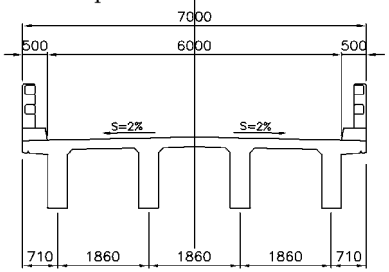
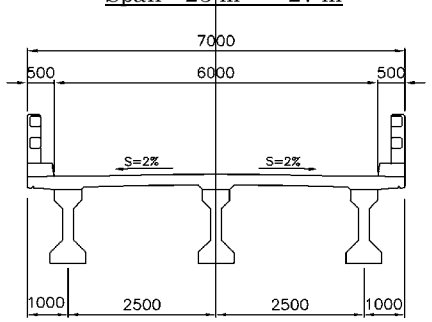
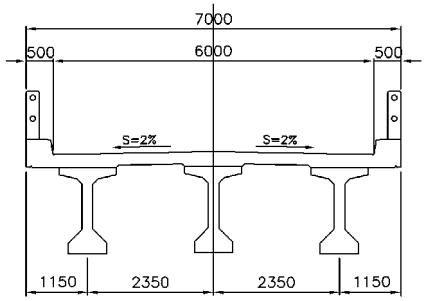
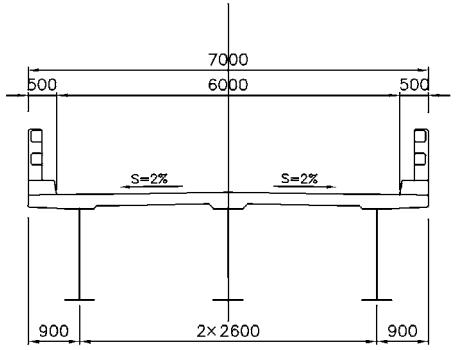
	Scheme-1 PC-I Girder		Scheme-2 Steel Plate Girder		Scheme-3 RC Girder	
Cross Section					<Span 5m ～ 15 m> 	<Span 15 m ～ 22 m> 
Structural Feature	-AASHTO standard design (I shape PC girder composed with RC deck slab) -Applicable span: 20 to 40 m -Span/height =1/15 to 1/20		-Girder is built-up -Non-composite with deck slab -H-beams are commonly used for spans less than 22 m -Applicable span: 25 to 45 m -Span/height =1/15 to 1/20		-RC flat slab: applicable span = 5 to 15 m -RC T Girder: applicable span=15 to 22 m -Span/height =1/13 to 1/15	
Procurement / Transportation Condition of Special Materials / Equipment	-All materials are available locally except PC cables -Aggregates good for PC concrete need to be purchased from suppliers -PC girders are fabricated at the site, therefore, no problem with access road condition for transportation -Girders are erected using erection girders		-Steel plates are available locally, large size H-beams are not -Fabricators are available locally -Hauling of girders is possible if the girders are segmented into short (6 to 7 m long) -Girders are erected using one set of bent after assembled on the ground		-RC bridges are common in Indonesia -All materials are available locally	
Constructability	-Fabrication yard necessary near project site -Fabrication and Erection of PC girders need specialist -High level safety management is needed for the erection of very heavy girders -Erection work can be eliminated by fabricating girders on scaffolding at site where applicable		-Quality of girder is guaranteed since they are fabricated in factories -Erection is relatively easy since the girders are not heavy -Assembly by bolt tightening is easy -Erection of girders is done during the dry season		-Required work quality is not high -Scaffolding work is required -Scaffolding work is possible only during the dry season	
Construction Duration	-Site work duration is longest -Total work duration is shorter than Scheme-2		-Site work duration is shortest -Total work duration is longest		-Total work duration is shorter than Scheme-1	
Cost	-More Costly than Scheme-3 but more economical than Scheme-2		-More costly than Scheme-1		-Most economical	
Maintenance Requirement	-Required maintenance is minimal		-Required maintenance can be reduced by using durable type paint		-Required maintenance is minimal	
Selection	The second best in terms of cost and constructability	○	Most costly	△	The best in terms of cost, constructability, maintenance requirement	◎

Table 2.2.2-3(2) Comparison of Superstructure Type (Span longer than 22 m)

Bridge Name		Bridge Dimension			Comparison of Superstructure Type	
		Bridge Length	Span (Pier center interval)	Minimum Span	Scheme-1 PC Girder	Scheme-2 Steel Plate Girder
NTT	Menu	260.0 m	32.410 + 6@32.530 + 32.410 m	31.0 m	8-span Connected PC T Girder	8-span Continuous Steel Plate Girder
	Fatuat	129.7 m	25.850 + 3@26.000 + 25.850 m	26.0 m	5-span Connected PC I Girder	5-span Continuous Steel Plate Girder
NTB	Tanaman I	35.0 m	1@34.000 m	--------	Single-span PC T Girder	Single-span Steel Plate Girder
	Puna Ⅲ	23.0 m	1@22.000 m	--------	Single-span PC I Girder	
	Tabisu I	24.0 m	1@23.000 m	--------		
	Tongoloka	48.0 m	2@23.650 m	23.5 m	2-span Connected PC I Girder	2-span Continuous Steel Plate Girder

	Scheme-1 PC Girder		Scheme-2 Steel Plate Girder	
Cross Section	Span=23 m ～ 27 m 	Span=27 m ～ 35 m 		
Structural Feature	-AASHTO standard design (I/T shape PC girder composed with RC deck slab) -Applicable span: 20 to 40 m -Span/height =1/15 to 1/20		-Girder is built-up -Non-composite with deck slab -Applicable span: 25 to 45 m -Span/height =1/15 to 1/20	
Procurement / Transportation Condition of Special Materials / Equipment	-All materials are available locally except PC cables -Aggregates good for PC concrete need to be purchased from suppliers -PC girders are fabricated at the site, therefore, no problem with access road condition for transportation -Girders are erected using erection girders		-Steel plates are available locally, large size H-beams are not -Fabricators are available locally -Hauling of girders is possible if the girders are segmented into short (6 to 7 m long) -Girders are erected using one set of bent after assembled on the ground	
Constructability	-Fabrication yard necessary near project site -Fabrication and Erection of PC girders need specialist -High level safety management is needed for the erection of very heavy girders -Erection work can be eliminated by fabricating girders on scaffolding at site where applicable		-Quality of girder is guaranteed since they are fabricated in factories -Erection is relatively easy since the girders are not heavy -Assembly by bolt tightening is easy -Erection of girders is done during seasons	
Construction Duration	-Site work duration is longest -Total work duration is shorter than Scheme-2		-Site work duration is shortest -Total work duration is longest	
Cost	-Little (3 to 4%) less than Scheme-2		-More costly than Scheme-1	
Maintenance Requirement	-Required maintenance is minimal		-Required maintenance can be reduced by using durable type paint	
Selection	Superior to Scheme-2 in terms of cost and maintenance requirement	◎	Costly than Scheme-1	○

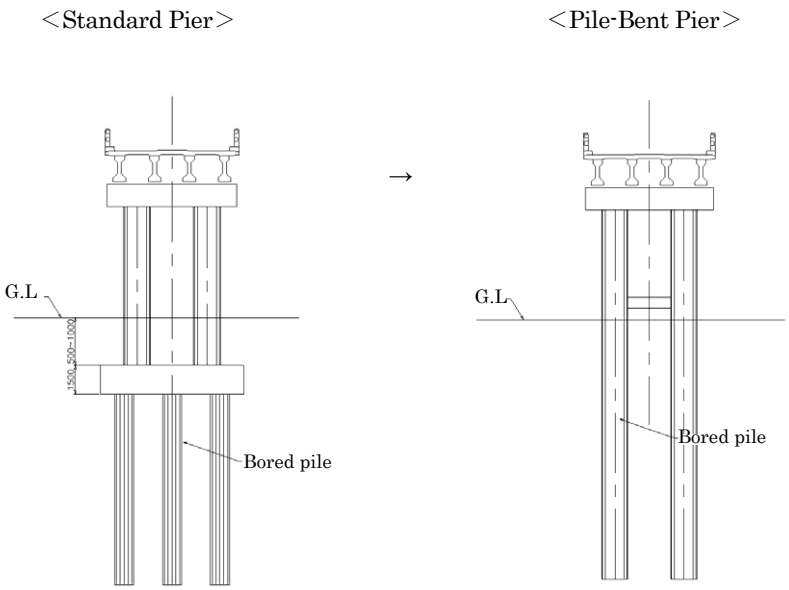
(3) Substructure

The height of abutments of considered bridges become 5m to 10m and bearing strata exists relatively shallow depth. Considering with stability and economy at proposed height of the abutments, inverted-T type abutment is the most superior and is adopted. Spread foundation is proposed for abutments located where bearing strata exists at shallow depth. However, foundation of abutment of Menu Bridge at right bank is designed with pile foundation since the bearing strata is relatively deep. Type of pile is cast in situ pile which is the same with pier foundations.

The pier type shall be the rigid frame pier in accordance with Indonesian Bridge Design Manual. The foundation type is adopted the cast in situ pile foundation which is more workable and economical on the underground condition consisted of the gravel layer with cobbles as such this project. The construction type is selected all through casting method, with rotary drilling machine ϕ 1.0m, considering with the depth of bearing strata and its geology, geological condition of drilling layers, underground water level and ability and workability of transportable equipment and materials. The result of the comparison for construction method of cast in situ pile is shown in Table 2.2.2-4.

However, the pile-bent pier, which is more economical and workable, is applied in case of low height pier and also satisfying earthquake-proof.

Table 2.2.2-4 Comparison of Bored Pile Drilling Methods

Cross Section					
Drilling Method		Earth Drill	Reverse	All Through Casing	
				Benoto	Rotary
Drill		Rotary Bucket	Rotary Bit	Hammer Grab	Cutter Bit ／ Hammer Grab
Bore-hole Prevention		Dry or Slurry	Water	Casing Tube	Casing Tube
Appli-cation to Soil	Clay/Silt	○	○	○	○
	Sand	○	○	○	○
	Gravel(D=10mm)	△	○	○	○
	Boulder(D=20cm)	×	×	○	○
	Cobble Stone	×	×	△	○
	Soft Rock	△	○	△	○
	Rock	×	○	△	○
Drill size (m)		0.8～3.0	0.6～4.5	1.0～2.0	1.0～4.2
Depth Limit (m)		Approx. 60.0	Approx. 70.0	Approx. 50.0	Approx. 60.0
Rental Cost		－	－	Medium	Costly
Applicability		×	×	○	◎

(4) Improvement of Tabisu II Bridge

Present Condition

Tabisu Ⅱ Bridge is located along the study road (See Photo 2.2.2-1) and, in case the project will be implemented, construction materials and equipment will be transported over this bridge. The bridge, which is RC T Girder, was constructed in 2002. However, despite the short span of two years since its construction, the structural integrity and traffic safety have rapidly deteriorated as evidenced by the damages observed on various parts of the structure.

Bridge Type	: Simple Span RC-T Type Girder Bridge
Bridge Length	: 15.6 m
Total Width	: 7.65 m (Carriageway Width : 6.250 m)
Number of Girders	: 5 girders (Spacing : 0.325 + 4 × 1.750 + 0.325 m)
Structural Depth	: 1.080 m (bridge surface to bottom of girder)
Completion year	: 2002

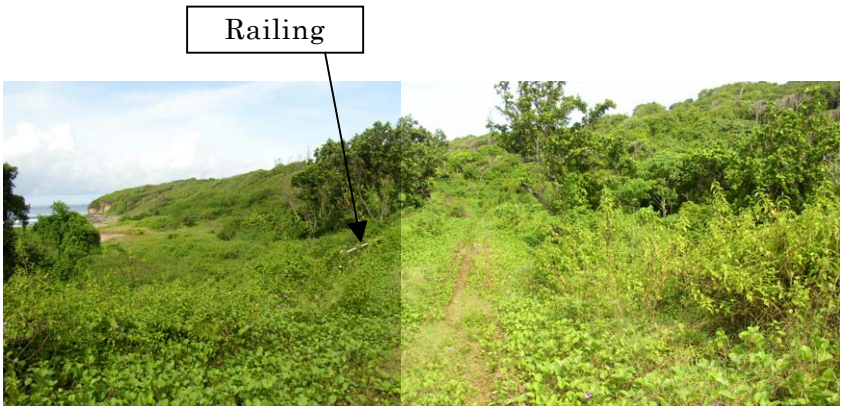
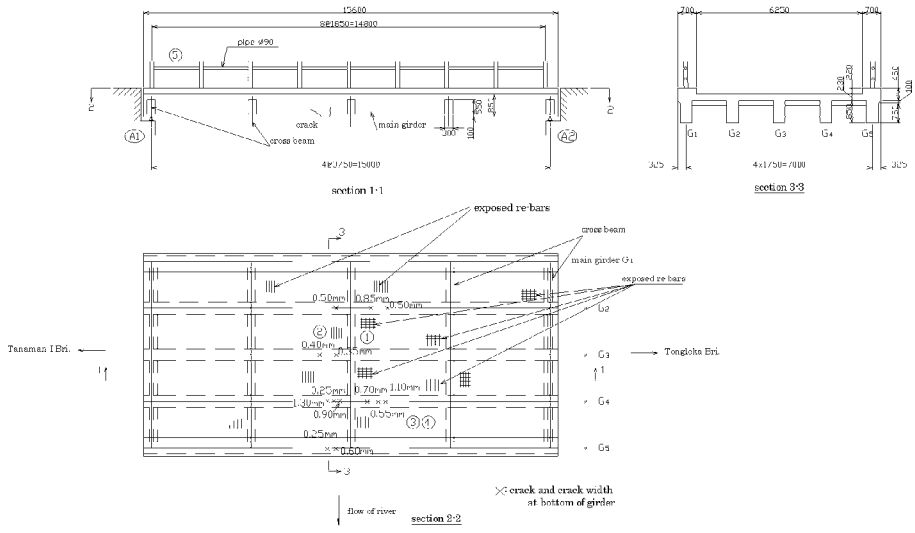


Photo 2.2.2-1 Tabisu Ⅱ Bridge Covered with Soil

A visual structural survey was conducted by the study team, the findings of which are shown in Table 2.2.2-5.

Table 2.2.2-5 Findings of the Visual Structural Survey on Tabisu Ⅱ Bridge

<table>
<tr><th></th><th colspan="2">Photos of Damages</th><th>Description</th></tr>
<tr><td>Deck Slab</td><td> 
Bottom Side(①)</td><td> 
Bottom Side(②)</td><td>・ Concrete at the bottom of the deck slabs have scaled off and reinforcing bars are exposed.
・ Corrosion on exposed re-bars is considerable.
・ Lack of necessary covers and very poor construction quality are assumed to be cause of the damages.</td></tr>
<tr><td>Girder</td><td> 
Girder Bottom(③)</td><td> 
Girder Side(④)</td><td>・ 2 to 6 cracks (0.25～1.10mm wide) appear at the middle of the span of every girder.
・ Honeycombs exist at the side of girders.</td></tr>
<tr><td>Railing</td><td> 
Railing(⑤)</td><td>―</td><td>・ Steel pipe rail and concrete posts are broken.</td></tr>
<tr><td colspan="4"> 
</td></tr>
</table>

Proposed Improvement Works

The stress level of the reinforcing bars is assumed based on the cracking condition at the middle of the spans since the drawings and design calculation report are not available. It is presumed that the girders have inadequate bending strength due to lack of reinforcing bars. As the countermeasure to improve the deck slabs and girders, three schemes are proposed and compared as shown in Table 2.2.2-6. Based on various factors considered, Scheme-3

(replacement of superstructure) is selected.

For the reference, the comparative methods of repair for cracks and scaling on concrete are presented in Table 2.2.2-7, and the methods of reinforcement of girders are given in Table 2.2.2-8.

Table 2.2.2-6 Comparison of Schemes for the Improvement of Tabisu Ⅱ Bridge

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="4">Scheme of Improvement</td></tr>
<tr><td>Scheme-1</td><td>Scheme-2</td><td colspan="2">Scheme-3</td></tr>
<tr><td colspan="2"></td><td>No repair/improvement (Temporary support during construction)</td><td>Repair</td><td colspan="2">Repair & Reinforcement</td></tr>
<tr><td colspan="2">Outline of Work</td><td>-Deck slabs and girders are temporarily supported to allow construction equipment and vehicles to pass over the bridge safely during construction.
-No repair will be made on deck slabs and girders.</td><td>-Deck slabs and girders are temporarily supported to allow construction equipment and vehicles to pass over the bridge safely during construction.
-Deck slabs and girders are repaired after the completion of construction.</td><td colspan="2">Method①: Replacement of superstructure
-Replace/reconstruct superstructure before the start of project construction.
-The existing substructure is used without repair.

Method②: Repair and reinforcement of existing bridge
-Deck slabs and girders are temporarily supported to allow construction equipment and vehicles to pass over the bridge safely during construction.
-Deck slabs and girders are repaired and reinforced to be capable to carry traffic after the project is completed.</td></tr>
<tr><td colspan="2">Detail of Work</td><td>-Two sets of concrete support are installed.</td><td><u>Girders</u>:
-Epoxy resin is injected into cracks.

<u>Deck slabs</u>:
-Polymer cement mortar is plastered on scaled sections.</td><td>① Replacement of Superstructure
-Detour is constructed then RC T girder (same as existing bridge) is constructed after removal of existing superstructure. And width of new bridge shall be adjusted with the standard section of this project
- Present :W=7.65m
- New :W=7.00m</td><td>②Repair & Reinforcement
<u>Girders</u>:
-Epoxy resin is injected into cracks then carbon fiber sheets are overlaid at the bottom side of the girders. (Please refer to Table 2.2-8)
<u>Deck slabs</u>:
-Polymer cement mortar is plastered on scaled sections. (Please refer to Table 2.2-7)</td></tr>
<tr><td colspan="6">Improvement Effect</td></tr>
<tr><td rowspan="2">Loading Capacity</td><td>Girder</td><td>No change</td><td>No change</td><td>Increase</td><td>Increase</td></tr>
<tr><td>Deck slab</td><td>No change</td><td>No change</td><td>Increase</td><td>No change</td></tr>
<tr><td rowspan="2">Dura-bilty</td><td>Girder</td><td>No change</td><td>Increase</td><td>Increase</td><td>Increase</td></tr>
<tr><td>Deck slab</td><td>No change</td><td>Increase</td><td>Increase</td><td>Increase</td></tr>
<tr><td colspan="2">Cost</td><td>Least Cost</td><td>Less than scheme-3</td><td>Little less than Scheme-3②</td><td>Most costly</td></tr>
<tr><td colspan="2">Evaluation</td><td colspan="4">Scheme-3① is selected since the improvement effect is the most and the cost is less than Scheme-3②.</td></tr>
</table>

Table 2.2.2-7 Comparison of Methods of Repair of Concrete Cracks and Scaling

	Repair of Cracks			Repair of Scaling		
	Painting	Crack Injection	Filling	Plaster	Spray	Pre-packed concrete
Description	Cover/seal small cracks with paint film	Inject resin/ cement into crack	Fill chipped area with resin/ cement mortar	Plaster over scaled area	Spray mortar on a wide area at bottom side of slab	Fill large scaled/chipped area with concrete
Applicable Case	Cracks narrower than 0.2 mm	Cracks width 0.2～1.0mm	Cracks wider than 1.0 mm. Additional method is needed for cracks wider than 3.0 mm	Scaling depth is shallow and area is small	Scaling depth is shallower than 10cm and area is wide	Repair section is large and at bottom side of slab
Material	-Polymer cement -Inorganic Cement	-Epoxy resin	-Flexible epoxy resin -Polymer cement mortar	-Mortar -Polymer cement mortar	-Polymer cement mortar -Early strength cement mortar	-Special filling material
Evaluation		◎		◎		

Table 2.2.2-8 Comparison of Methods of Reinforcement of Girders

			Steel Plate Patching	Carbon Fiber Sheet Patching	Section Enlargement
Description	Method		Patching of steel plates on girder bottom using anchor bolts and epoxy resin	Patching of carbon fiber sheets on birder bottom (and sides) using epoxy resin	Installation of additional reinforcing bars at bottom (and sides) and concreting by spraying of polymer cement mortar
	Increase of dead load by work		Approx. 40 kg／m²	Approx. 4 kg／m²	Approx 170～250 kg／m²
	Effect	Bending	◎	◎	◎
		Shear	○	△	△
		Water seal	△	△	△
	Popularity in Japan		Very popular (30%)	Popular (20%)	Not popular (4%)
Constructability		Scaffolding	・Needed	・Needed	・Needed
		Specialist	・Needed	・Needed	・No needed
		Heavy Equipment	・Needed	・Not needed	・Not needed
		Safety	・ Hauling and installation of steel plates needs care	・All materials are light	・All materials are light, except reinforcing bars
Cost			・ Less costly than carbon fiber sheet patching method	・Most costly	・Least cost
Construction Duration			・Shorter than the section enlargement method	・Shortest	・Longest
Maintenance Requirement			・Periodic repainting is required	・No maintenance required	・Periodic inspection is required
Evaluation				◎	

(5) Bridge Design Criteria

1) Design Specifications

The Bridge Design Code and the Bridge Design Manual issued by the Ministry of Public Works of the Republic of Indonesia is generally applied in the design of bridge as the design specifications. However, the appropriateness of the criteria is enhanced using specifications of Japanese Road Association (JRA) and the American Associations for State Highway and Transportation Officials (AASHTO) as reference. The items which are not specified in the Indonesian specifications are supplemented by JRA specifications.

2) Bridge Width Component

Indonesian National Road Type B is adopted for the project as shown Figure 2.2.2-1.

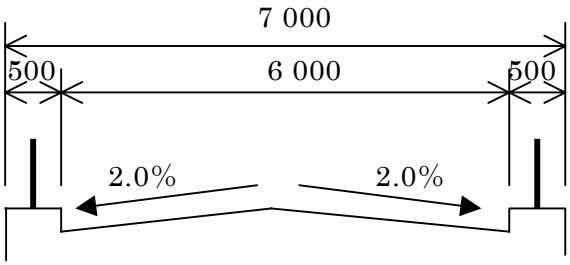


Figure 2.2.2-1 Standard Bridge width Component

3) Design Load

- Live Load: As specified in the Bridge Design Code
- Temperature Change: 15℃ ～ 40℃ (for concrete girder)
- Seismic Load: As specified in the Bridge Design Manual

(Basic shear coefficient for the project area is 0.18 (Zone 3))

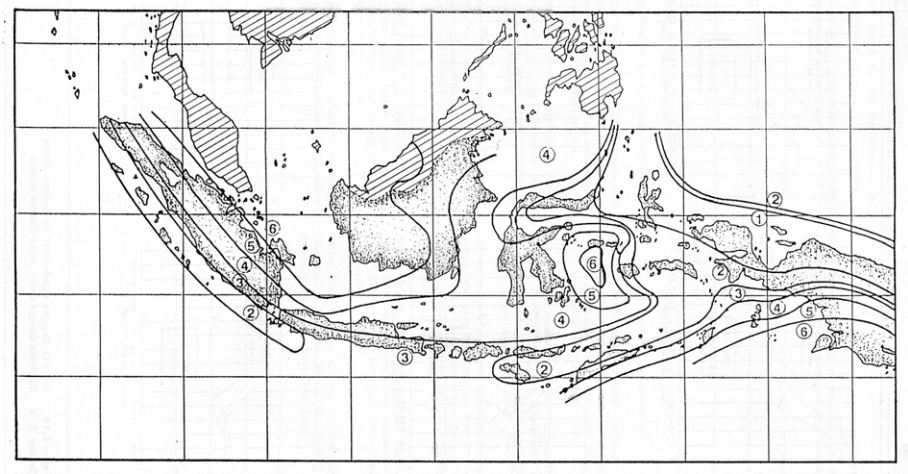


Figure 2.2.2-2 Map of Seismic Zone for Basic Shear Coefficient

4) Materials

Specifications of the basic materials are shown in Table 2.2.2-9.

Table 2.2.2-9 Specifications of Basic Materials

Material		Design Strength	Specification (in Japan)
Concrete	PC Girders	40 Mpa	-
	RC Girders	25 Mpa	-
	Deck Slabs	25 Mpa	-
	Abutments, Piers	25 Mpa	-
	Bored Piles	30 Mpa	-
	Plain Concrete	20 Mpa	-
Reinforcing Bars	Round Bars	-	SR235 (Yield strength 240 Mpa)
	Deformed Bars	-	SR345 (Yield strength 390 Mpa)
PC Cables	prestressing - steel strand	-	SWPR7AL (12.4mm*7nos) (Tention strength 165 KN)

5) Design Flood Frequency

50-year return period

(6) Bridge Accessories

1) Bearings

The rubber bearing pad is adopted since it is corrosion free.

2) Expansion Joints

The slide plate type expansion joints, which are simply assembled with steel plates and angle bars, are adopted.

3) Falling Girder Stopper

Concrete block stoppers are installed in front of cross beams to prevent superstructures from falling down.

4) Railing

Galvanized steel pipe rails installed on concrete posts are adopted as these are commonly used in Indonesia.

5) Others

The newel post is installed at entrances and exits of the bridge and fixed a record plate of the bridge. The back of abutment is paved by asphalt penetration macadam. Approach slabs are not installed at present, however, corbels for approach slabs are attached on abutments in case this will be needed in the future.

2.2.2.3 Approach Roads and Ancillary Facilities Design

(1) Approach Road

1) Geometric Standards

- Design speed: 50 km/hr (standard section)
- Minimum radius: 80 m (standard section)
- Maximum slope: 10 % (16% is adopted for the left bank side of Menu Br. due to the restriction by the topography)

2) Road Improvement Sections

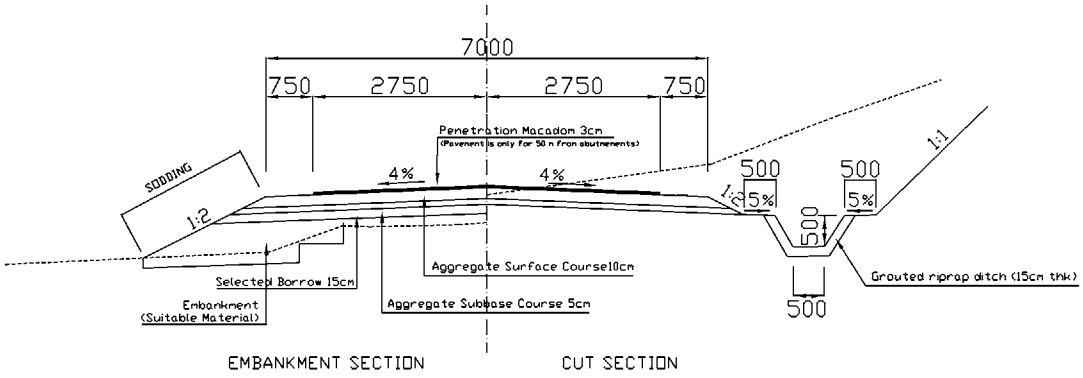
- Bridge approach roads to be improved under this project are within areas where the new road alignments meet with existing alignments.
- Access roads to be temporarily improved are sections necessary for function as the transportation required for this project.

Pavement structure is shown in Figure 2.2.2-3.

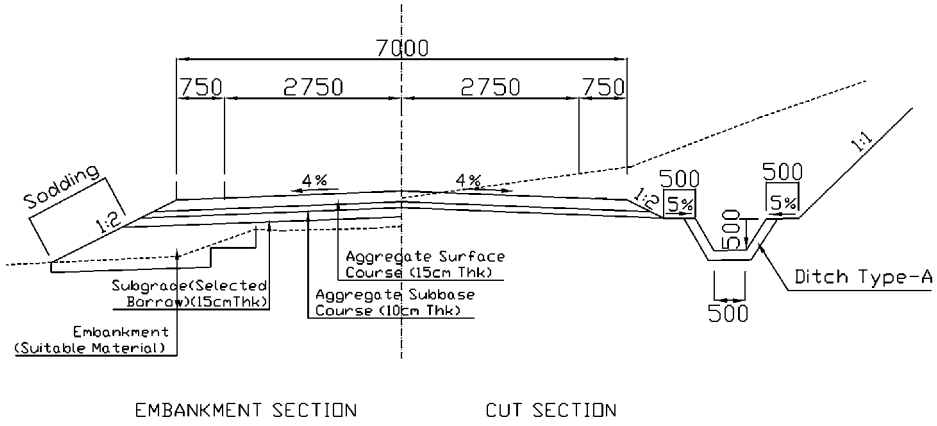
- Sections of 50m long from Bridges : Asphalt Penetration Macadam*

  *Exception : Tabisu II Bridge

  Tongoloka Side 200.0m , Tongo Side 150.0m
- Remaining Sections : Gravel



(a) Penetration Type Macadam Pavement (25m long only from bridge)



(b) Gravel Type Pavement (remaining sections)

Figure 2.2.2-3 Typical Cross Section of Approach Road

(2) Ancillary Facilities

Strong erosion along the gravelly riverbanks at Fatuat Bridge is occurring and the progress of the erosion is foreseen, therefore, river dikes made of stone masonry gravity wall is proposed to prevent the river from further eroding and meandering. At other bridge sites, the river alignment is relatively stable since the riverbanks are rocky. Installation of grouted riprap revetments around the abutments is proposed to protect slopes around them from erosion. A comparison of revetment types is shown in Table 2.2.2-10.

Installation of boulders (size is 300 mm in average) is proposed for foot protection from scouring. A comparison of scour protection types is shown in Table 2.2.2-11.

No protection work is proposed against local scouring around the piers since the footing of Menu Bridge and Tongoloka Bridge are embedded beyond the scour depths and Fatuat Bridge has pile-bent type piers.

Table 2.2.2-10 Comparison of Revetment Types

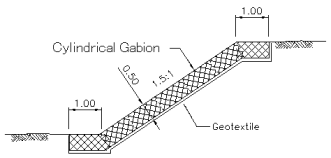
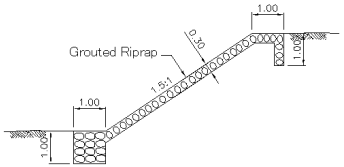
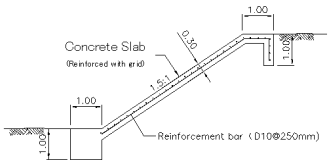
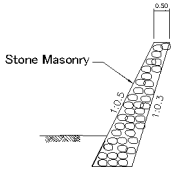
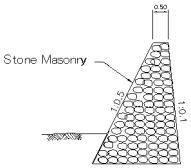
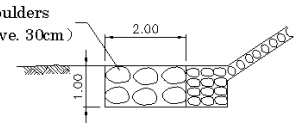
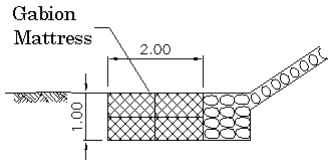
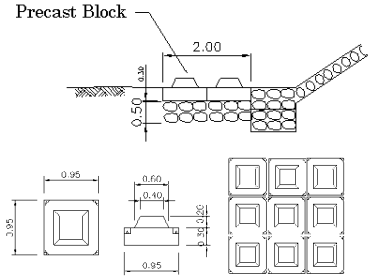
	Scheme-1	Scheme-2	Scheme-3	Scheme-4	Scheme-5
Type	Cylindrical Gabion	Grouted Riprap	Concrete Slab	Stone Masonry Wall	Stone Masonry Gravity Wall
v Structural Illustration					
Material Procurement Condition	-Durable type gabion nets are not available from local market but are available from other countries. -Other materials are available at the site	-All materials are available at the site.	-All materials are available at the site.	-All materials are available at the site.	
Construct-ability	-Very easy -Applicable for gentle slope	-Very easy -Applicable for gentle slope	-Easy -Applicable for gentle slope	-Easy -Applicable for steep slope -Applicable for sound ground for foundation	-Easy -Applicable for any location since it is free standing -Applicable for sound ground for foundation
Durability	-Steel mesh corrodes and breaks after around 15 years from construction. -Steel mesh might break when hit by a big drifting boulder	-Durable -Backfill erosion may damage grouted riprap	-Very durable	-Very durable	
Cost	-Gabion mesh is costly	-Most economical	-Most costly	-Relatively economical	-Relatively economical
Evaluation	△ -Costly and less durable	◎ -Economical, easy to construct and durable	△ -Costly and less durable	◎ -Economical, easy to construct and durable	◎ -Economical, easy to construct and durable
Selection	—	For Menu, Tanaman I, Tabisu I, Tabisu Ⅲ, Tabisu Ⅳ, Tabisu V, Tongoloka Bridge	—	For Puna I Bridge	For Left bank of Meno Bridge, Fatuat Bridge

Table 2.2.2-11 Comparison of Foot Protection Types

	Scheme-1	Scheme-2	Scheme-3
Type	Boulders	Gabion Mattress	Concrete Block
Structural Illustration			
Material Procurement Condition	-Large boulders, more than 50cm in size, may need to be hauled from upstream of rivers	-Durable type gabion nets are not available from local market but are available from other countries. -Other materials are available at the site	-Concrete block can be easily fabricated at the sites
Applicability/ Construct-ability	-Disadvantageous for sites where large size boulders are not available -Very easy construction	-Applicable for any site -Mesh needs to be deformed where slopes are not straight	-Advantageous for sites where large size boulders are not available -Concrete blocks have to be fabricated
Durability	-Large size boulders are needed where flood velocity is very fast to prevent boulders from washing out.	- Steel mesh corrodes and be necessary a repair after around 15 years from installation. -Steel mesh might break when hit by a big drifting boulder	-Very durable
Cost	-Most economical	-Costly than Scheme-1	-Most costly
Selection	◎		
	Scheme-1 is economical, durable and construction is easy. Therefore, it is used for all sites.		

2.2.3 Basic Design Drawings

Basic design drawings are shown in Figure 2.2.3-1～-11. The outline of the bridge design is summarized in Table 2.2.3-1.

Table 2.2.3-1 Outline of Bridge Design

Bridge Name	Bridge Length (m)	Span (@ Pier Center) (m)	Superstructure Type	Abutment			Pier			Length of Approach Road (m)
				No. of Unit	Type	Foundation	No. of Unit	Type	Foundation	
NTT										
Menu	260.0	32.410 + 6×32.375 + 32.410	8-span Connected PC T Girder	2	Invert-ed-T	Bored Pile (Φ1.0m) A:6pile×8.0m B: Spread Foundation	7	2-column	Bored Pile (Φ1.0m) P1： 6 pile× 8.0m P2： 6 pile× 9.0m P3： 6pile×10.0m P4,P5,P6,P7 : 8 pile×10.0m	614.5
Fatuat	129.7	25.850 + 3×26.000 + 25.850	5-span Connected PC I Girder	2	Invert-ed-T	A, B: Spread Foundation	4	Pile-bent	Bored Pile (Φ1.0m) P1,P2,P3,P4: 2 pile×20.0m	420.3
NTB										
Tanaman I	35.0	34.000	Single-span PC T Girder	2	Invert-ed-T	A, B: Spread Foundation	No pier			145.0
Puna I	11.2	10.000	Single-span RC Flat Slab	2	Invert-ed-T	A, B: Spread Foundation	No pier			88.0
Puna Ⅲ	23.0	22.000	Single-span PC I Girder	2	Invert-ed-T	A, B: Spread Foundation	No pier			77.0
Tabisu I	24.0	23.000	Single-span PC I Girder	2	Invert-ed-T	A, B: Spread Foundation	No pier			116.0
Tabisu Ⅲ	20.0	19.000	Single-span RC T Girder	2	Invert-ed-T	A, B: Spread Foundation	No pier			130.0
Tabisu Ⅳ	22.0	21.000	Single-span RC T Girder	2	Invert-ed-T	A, B: Spread Foundation	No pier			98.0
Tabisu V	22.0	21.000	Single-span RC T Girder	2	Invert-ed-T	A, B: Spread Foundation	No pier			88.0
Tongoloka	48.0	2×23.650	2-span Connected PC I Girder	2	Invert-ed-T	A, B: Spread Foundation	1	2-column	Bored Pile (Φ1.0m) P1： 6 pile×10.0m	147.0
Replacement of Superstructure										
Tabisu Ⅱ	15.6	15.000	Single-span RC T Girder	2	The existing substructure is used without repair .		No pier			350.0

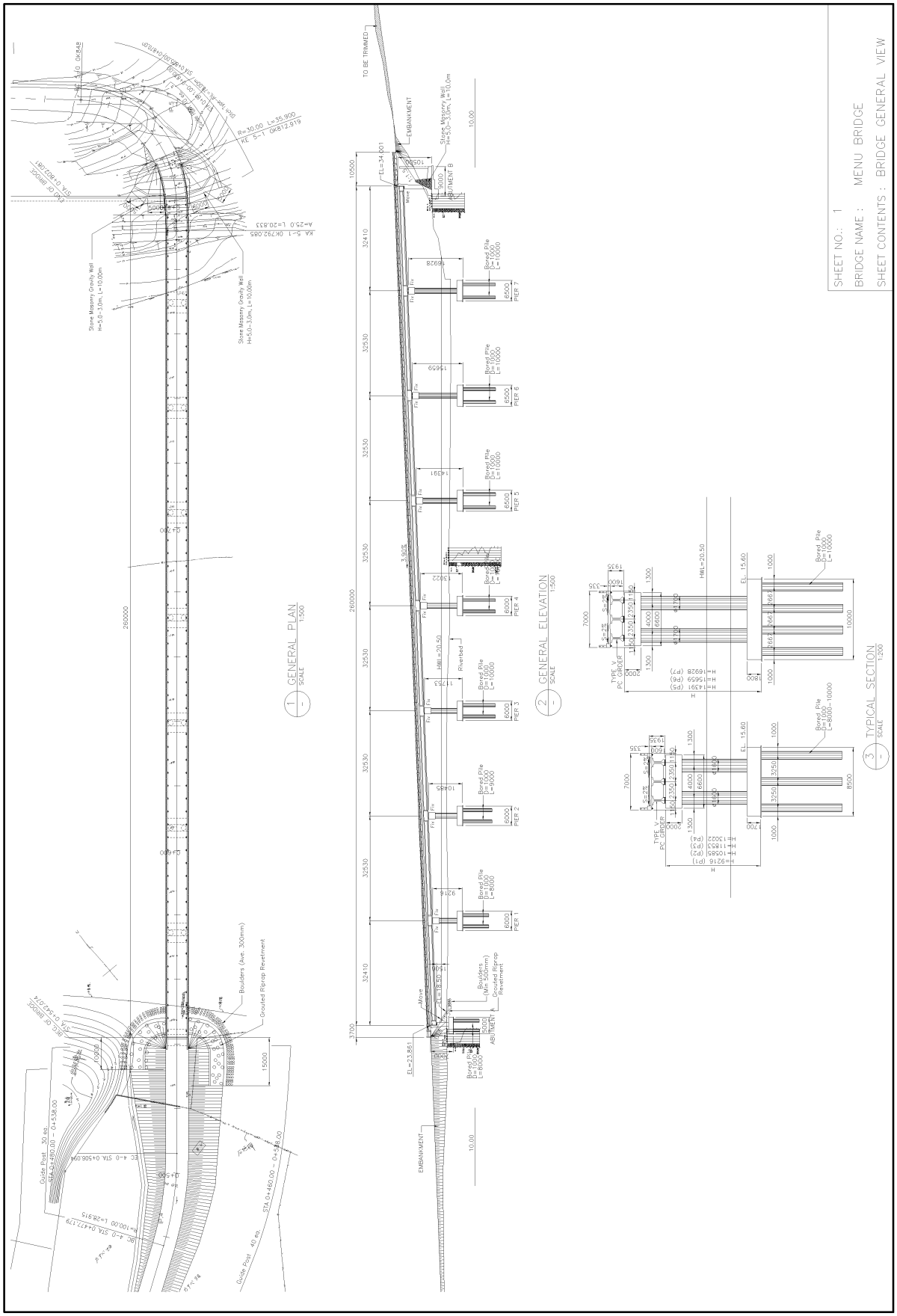


Figure 2.2.3-1 Bridge General View of Menu Bridge

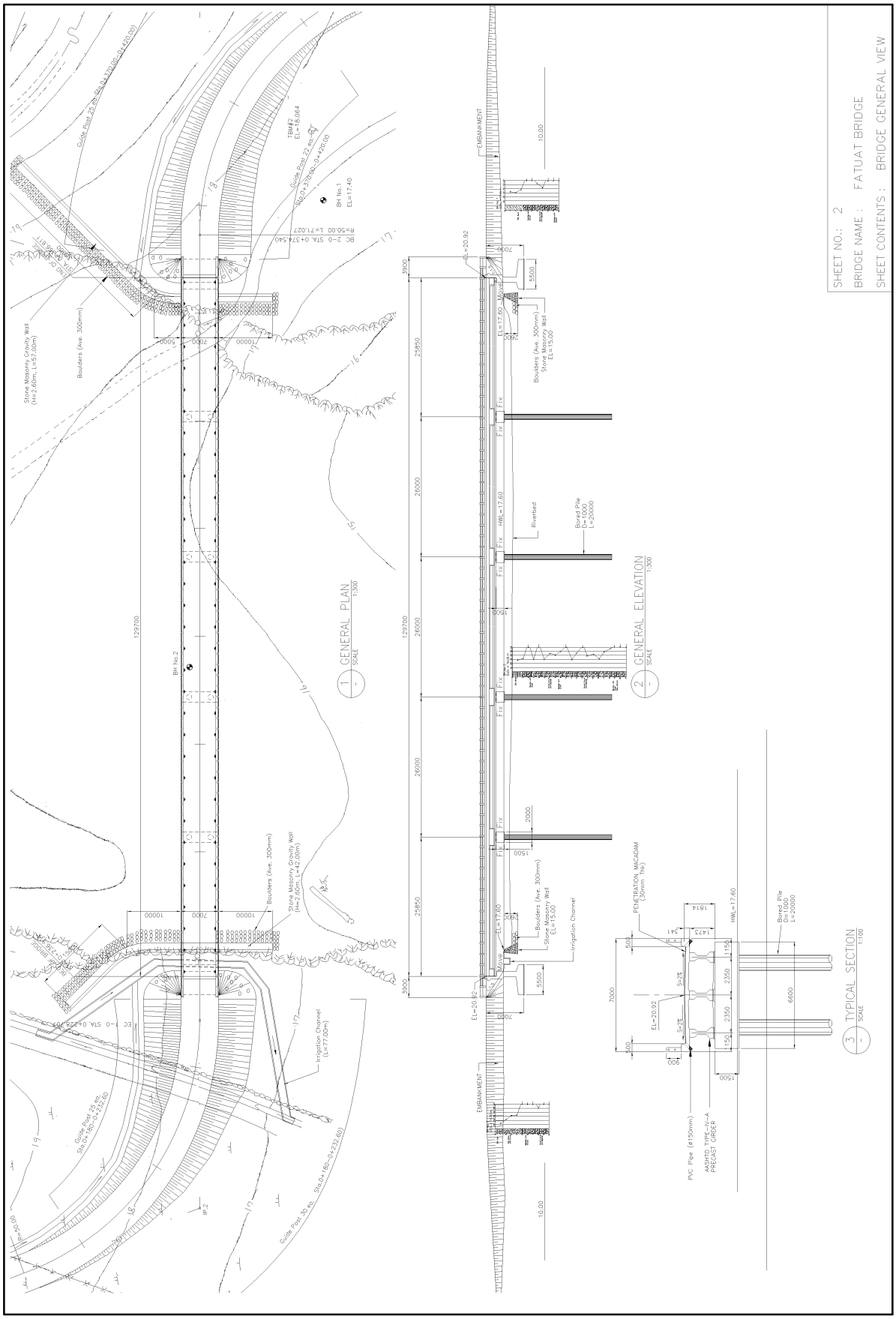


Figure 2.2.3-2 Bridge General View of Fatuat Bridge

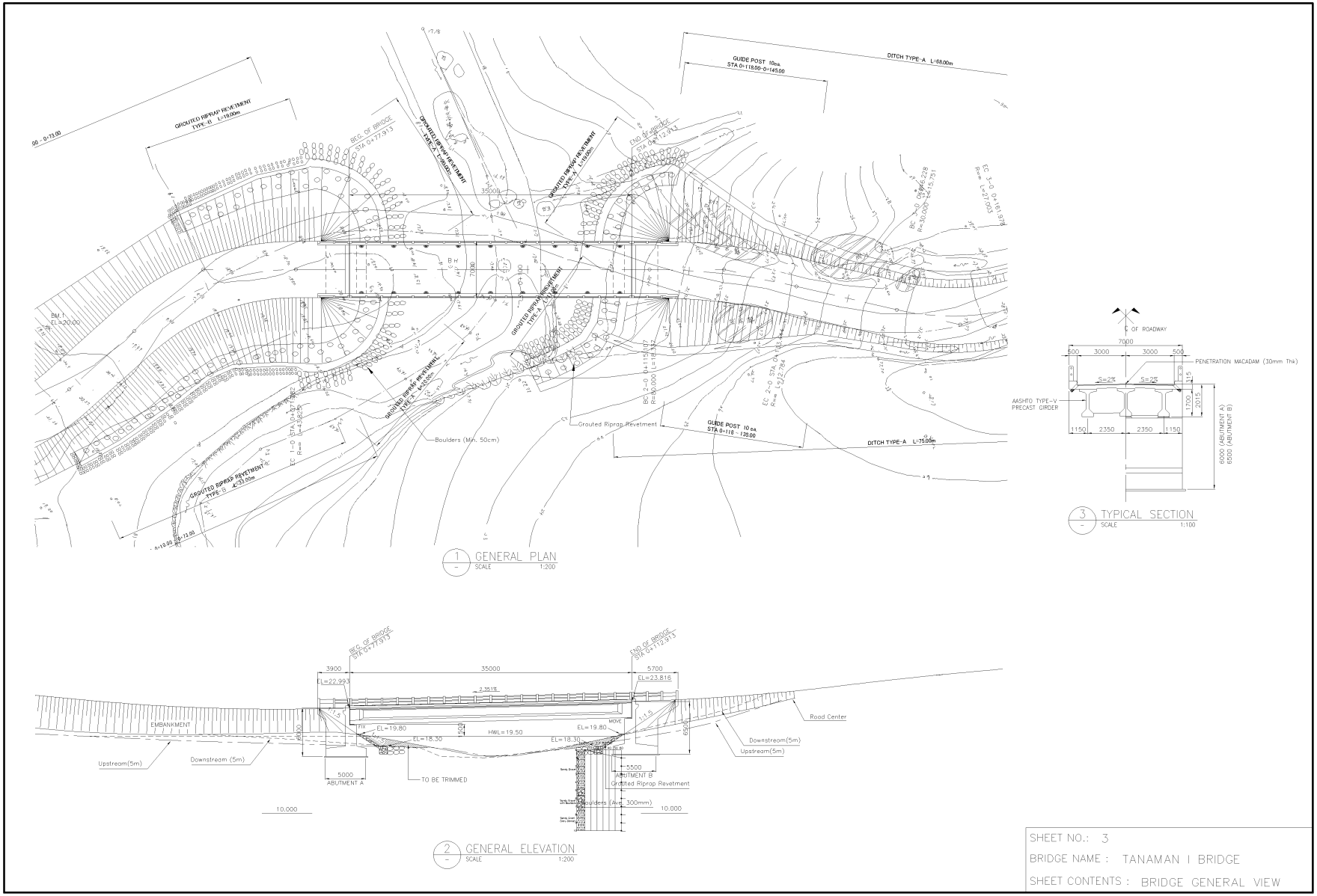


Figure 2.2.3-3 Bridge General View of Tanaman I Bridge

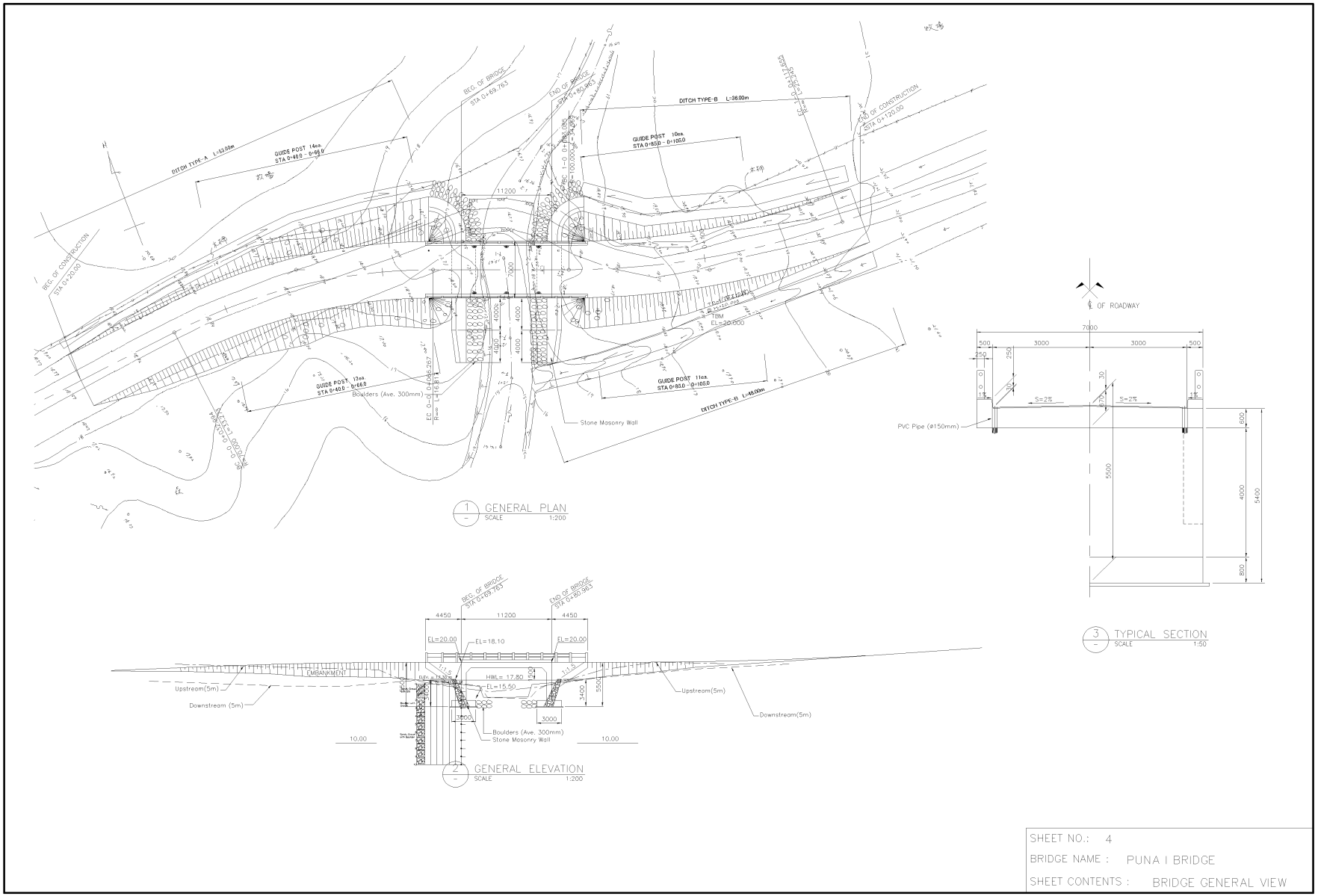


Figure 2.2.3-4 Bridge General View of Puna I Bridge

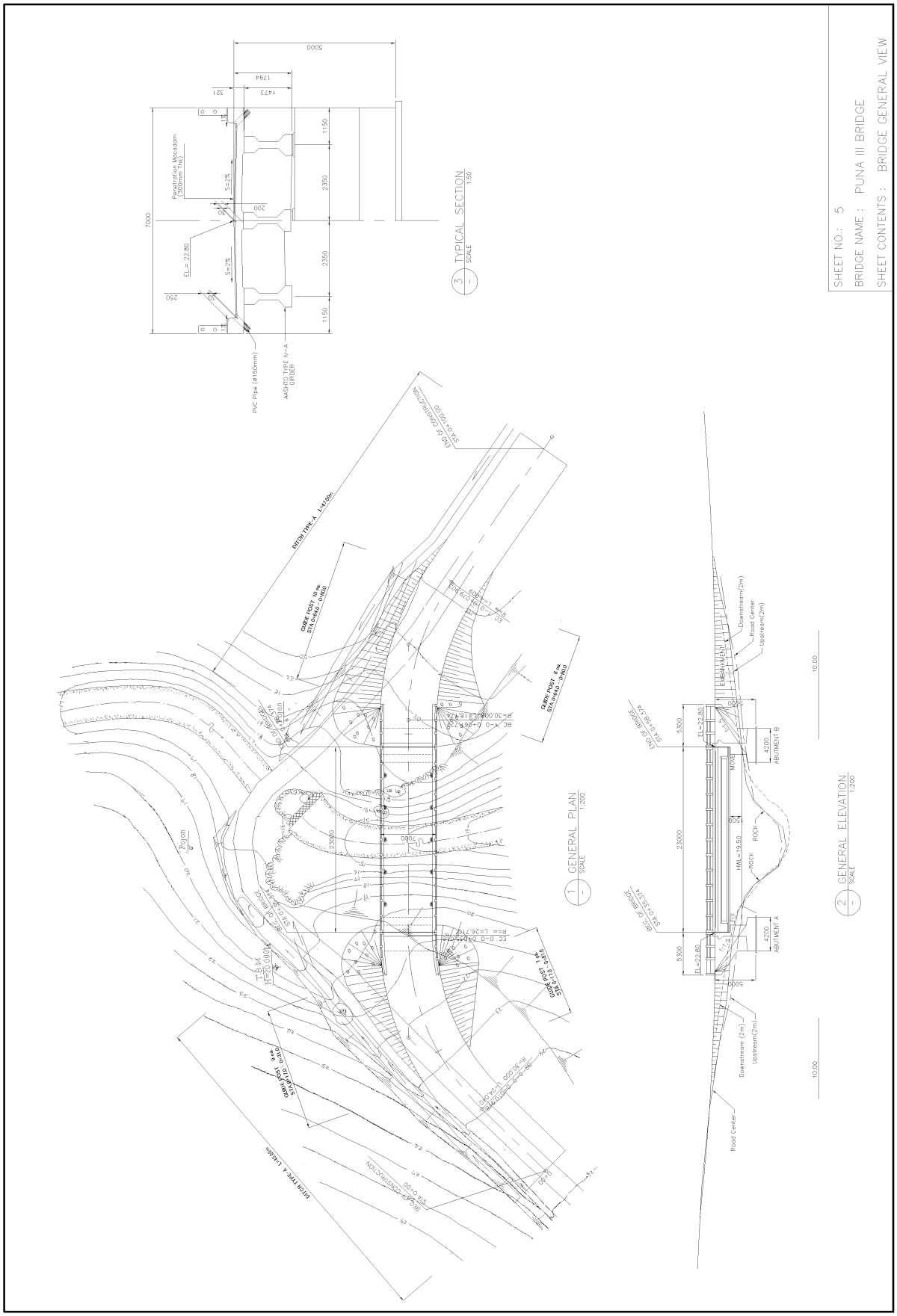


Figure 2.2.3-5 Bridge General View of PunaⅢ Bridge

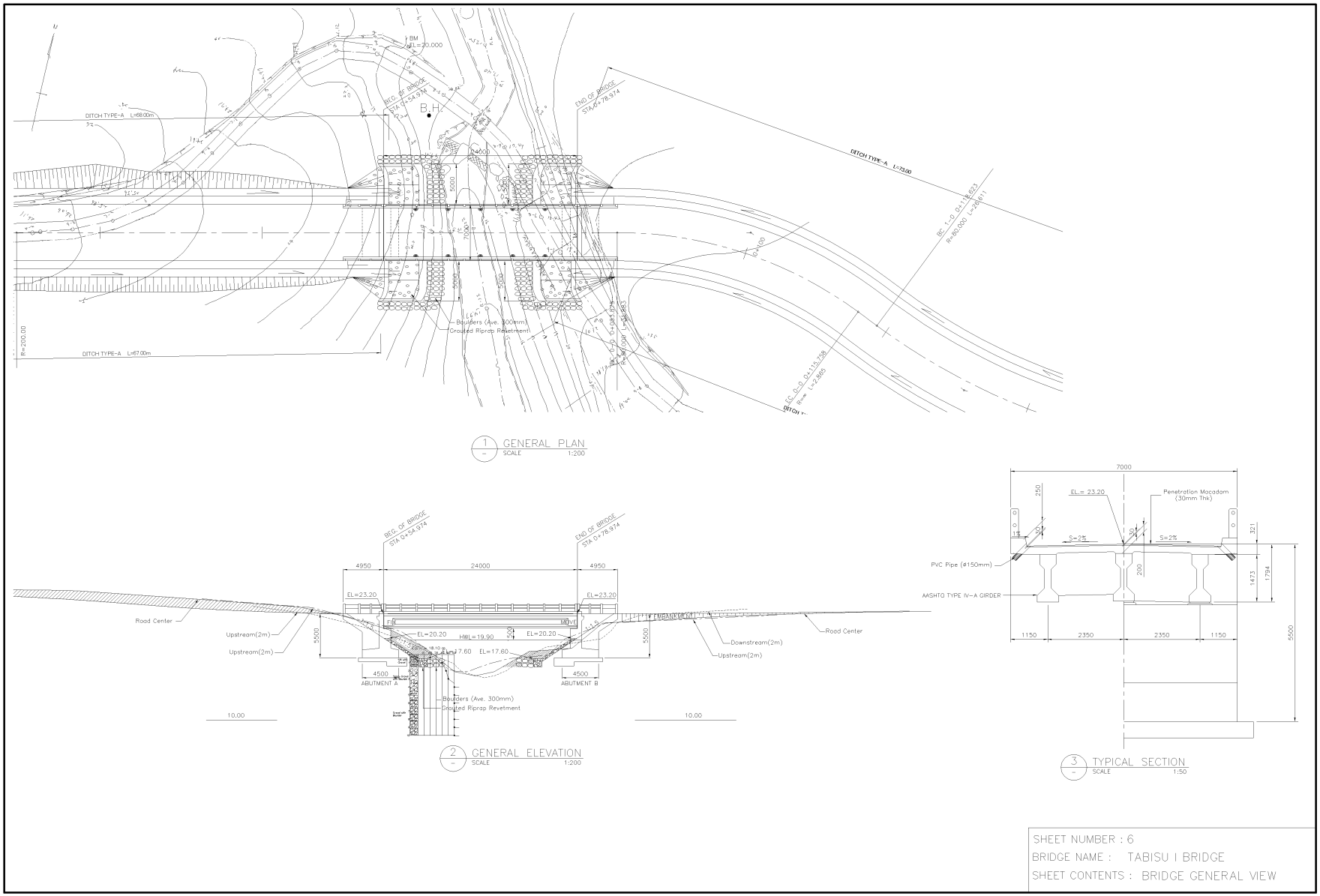


Figure 2.2.3-6 Bridge General View of Tabisu I Bridge

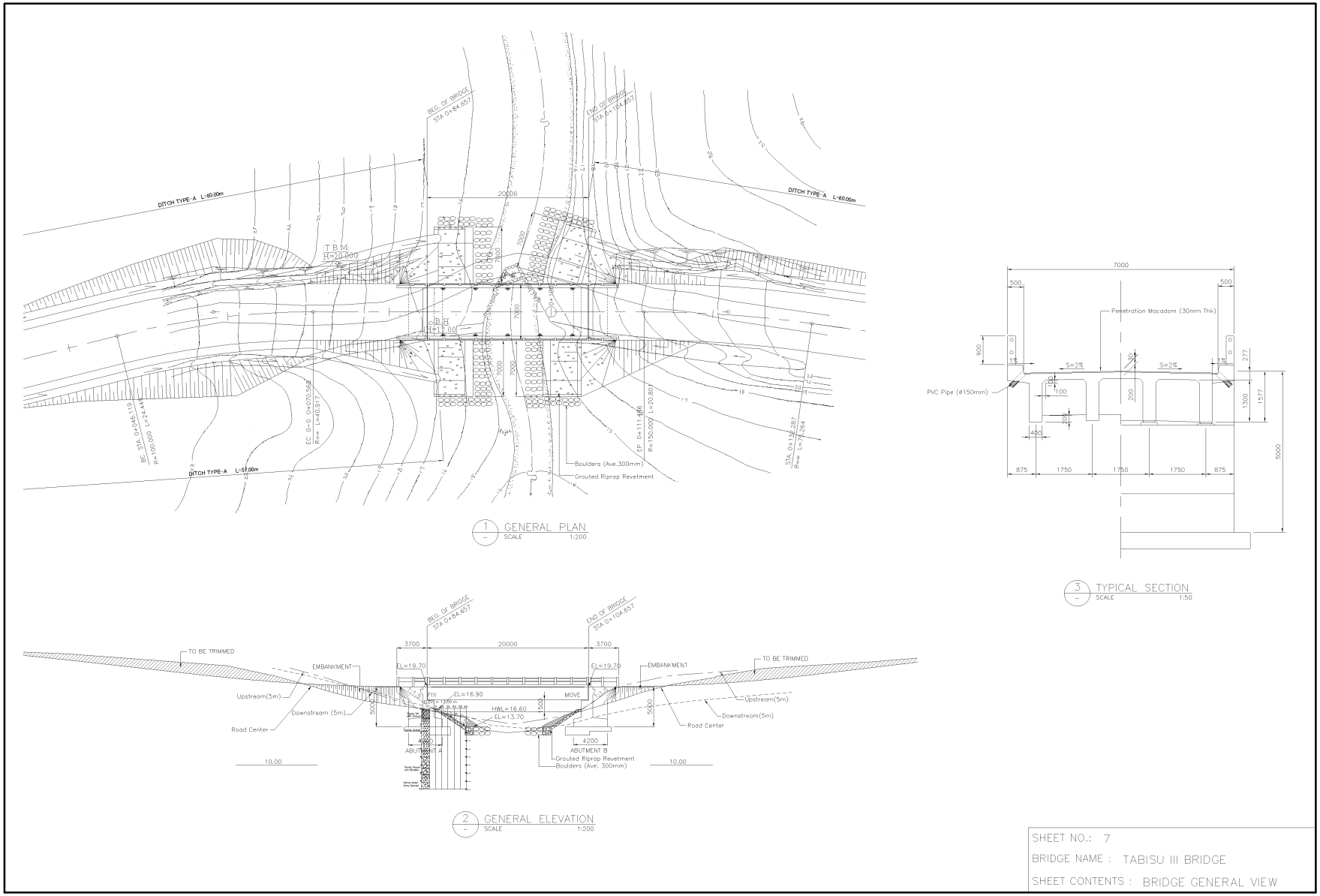


Figure 2.2.3-7 Bridge General View of TabisuⅢ Bridge

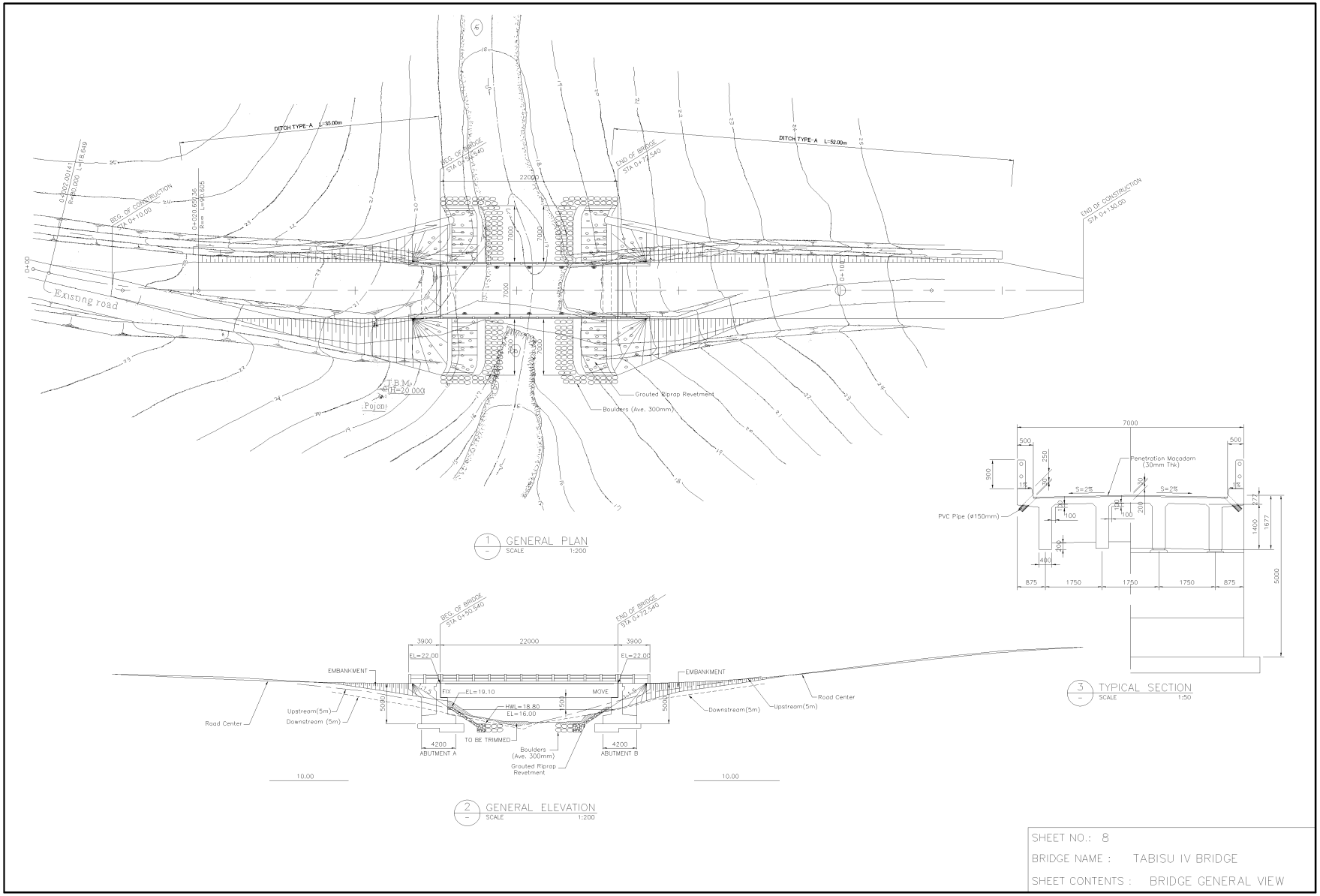


Figure 2.2.3-8 Bridge General View of TabisuⅣ Bridge

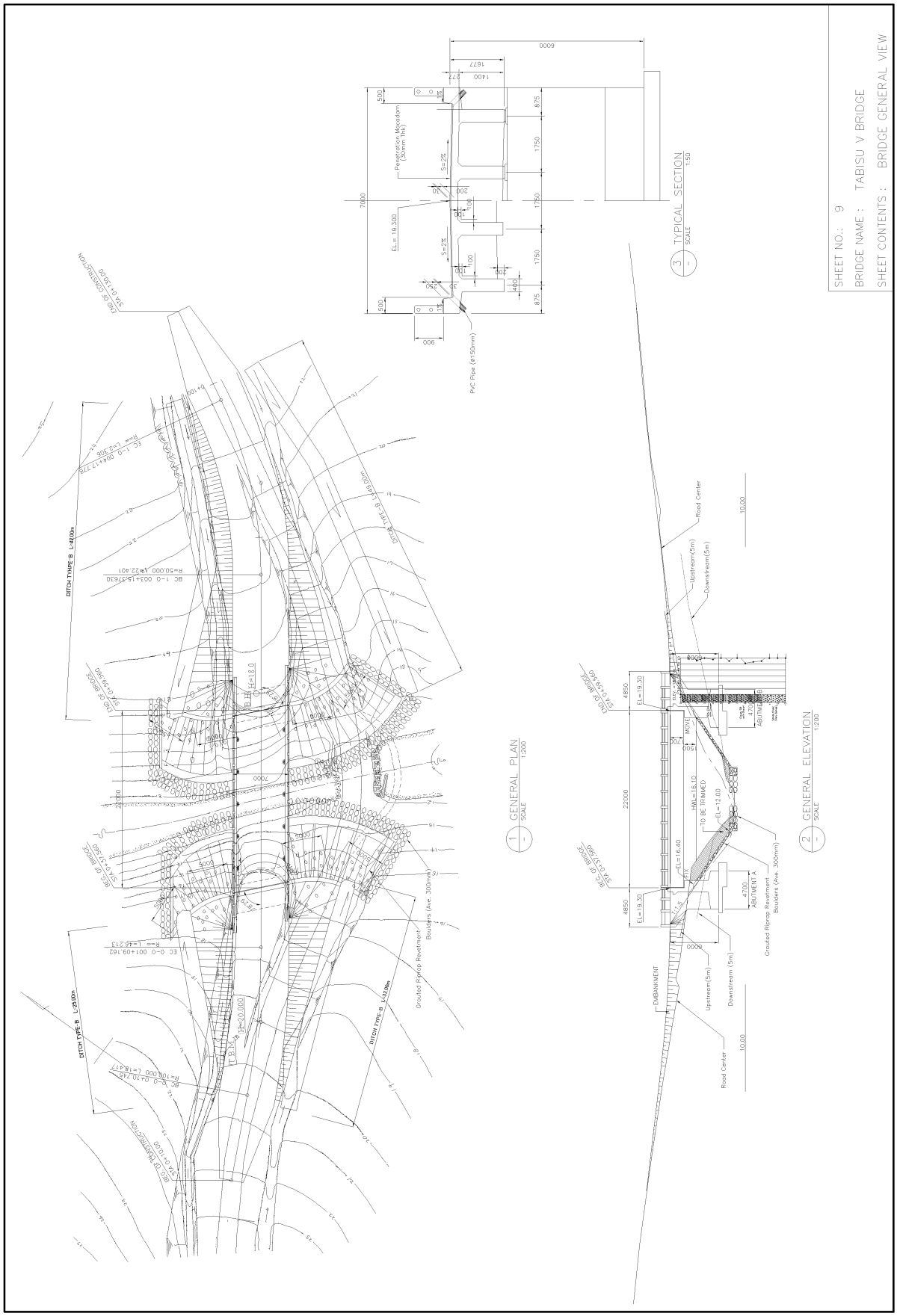


Figure 2.2.3-9 Bridge General View of TabisuV Bridge

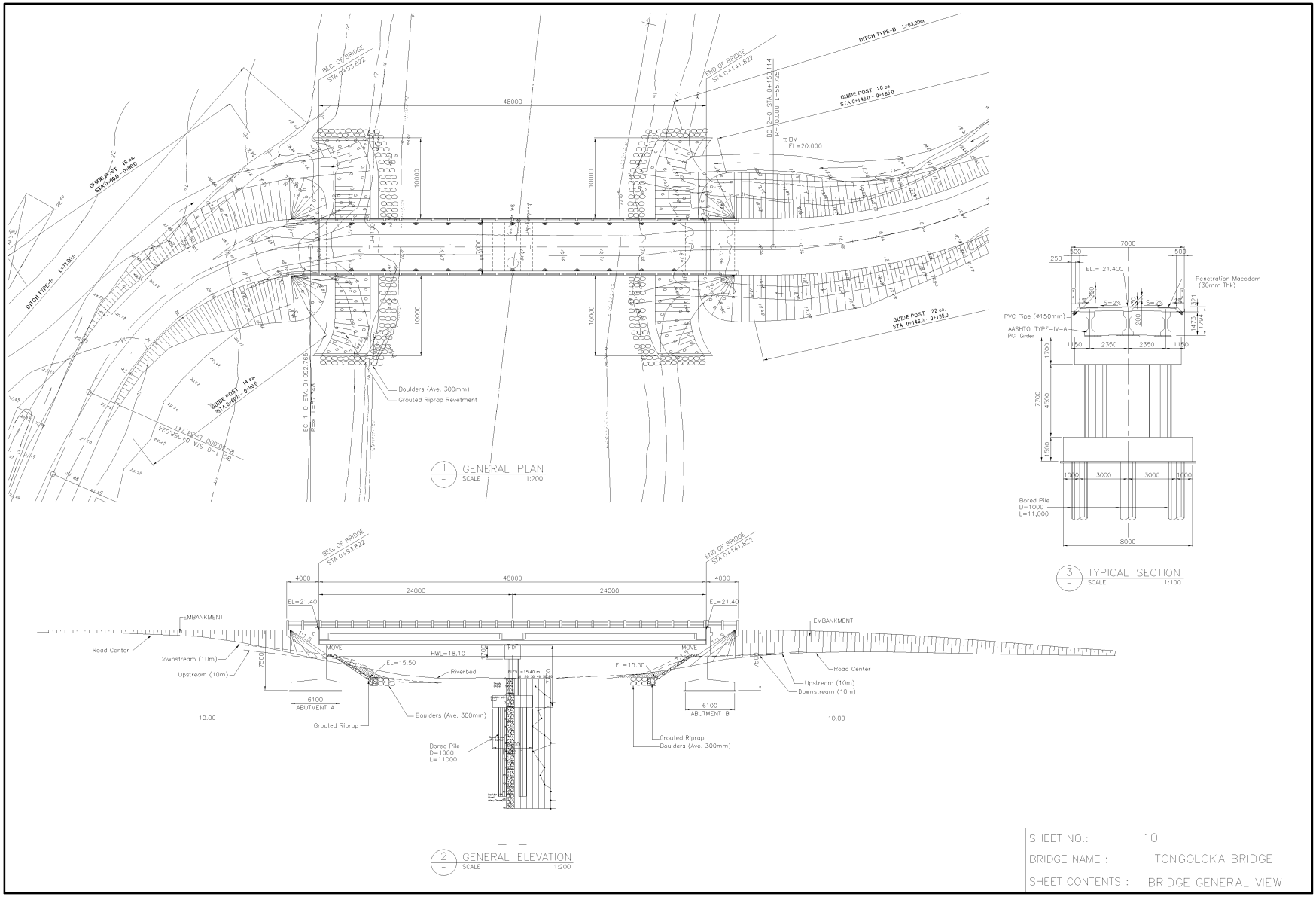
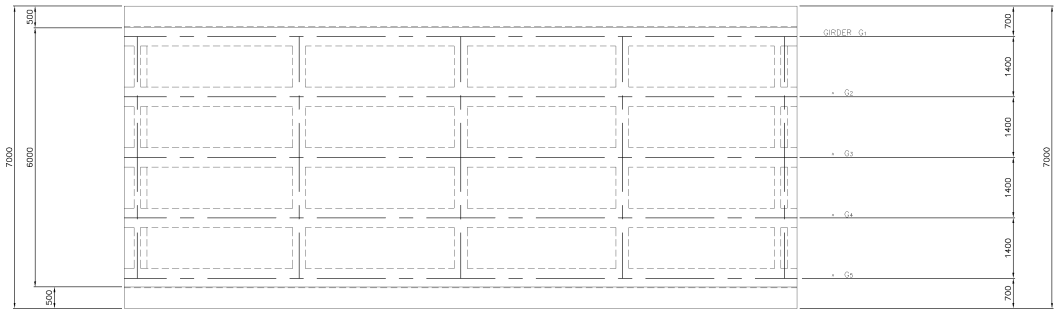
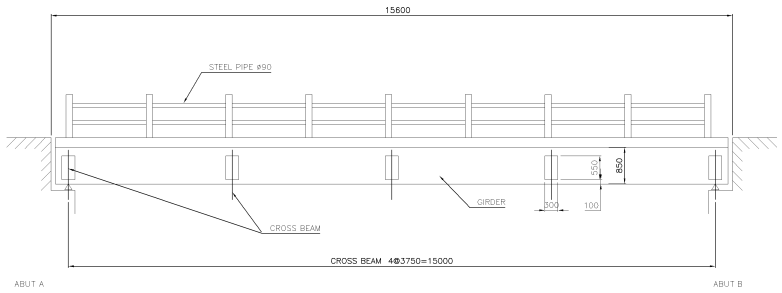


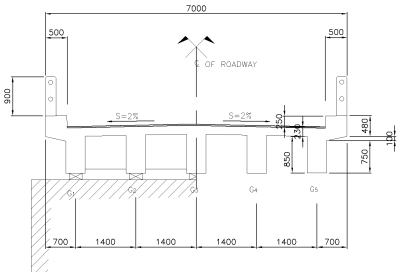
Figure 2.2.3-10 Bridge General View of Tongoloka Bridge



1 PLAN
SCALE 1:50



2 ELEVATION
SCALE 1:50



3 TYPICAL CROSS-SECTION
SCALE 1:50

SHEET NO.: 11
BRIDGE NAME : TABISU II BRIDGE
SHEET CONTENTS : BRIDGE GENERAL VIEW

Figure 2.2.3-11 Bridge General View of TabisuⅡ Bridge

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

The basic conditions for implementing the Project are as follows:

- The Project, if approved, will be implemented in accordance with the guidelines of Japan's Grant Aid scheme after the signing of the Exchange of Notes between the Government of Japan (GOJ) and the Government of Indonesia (GOI).
- The Ministry of Public Works (MOP) is responsible for implementing the Project.
- The detailed design of the bridges, assistance in tendering and construction supervision of the Project will be undertaken by a Japanese consulting firm in accordance with a contract between the MOP and the consultant.
- The construction will be undertaken by the successful Japanese tenderer in awarding the contract with the MOP.

The basic concepts in the implementation plan are as follows:

- Materials and equipment necessary for the Project will be procured in Indonesia as far as available. Items unavailable locally will be procured from Japan or third countries, which will be selected on the basis of cost, on condition that the quality and supplying capacity meet the requirements.
- The construction method and schedule will be planned reflecting local conditions of climate, topography, geology and so on.
- Easy and common method of construction, not needing special equipment nor technology, will be adopted for the Project as much as possible.
- Organizations for construction management by the contractor and construction supervision by the consultant will be established meeting the standardized construction management requirements.
- The traffic shall be maintained during construction, and necessary measures for safety shall be taken.
- Full attention shall be paid to the environmental preservation during construction, preventing outflow of soil in the rainy season and water pollution of the river; note, however, that Fatuat Bridge and Menu Bridge which are longer than 60m shall be appropriately monitored by Indonesia side with preparation of UKL and UPL.

2.2.4.2 Implementation Conditions

The Project is to newly construct the bridges except for Tabisu II Bridge, the types of which were selected through the comparison study in terms of construction difficulties, maintenance activities, construction cost, etc.

Tabisu II Bridge, which is RC girder type bridge with a length of 15 m, is recommended to be replaced with a new superstructure, utilizing the existing abutments, which was constructed in 2002.

- Superstructure : PC Girder Type, RC Girder Type and RC Deck Slab Type
- Substructure : Reversed T Type Abutment and Rigid Frame Type Pier
- Foundation : Spread Foundation and Bored Pile

The followings are major items to be considered in the construction planning for the above structural types.

(1) Quality in Casting and Safety in Installation of PC Girders

The full attention shall be paid to maintain the required quality in casting of PC girders and to secure the safety in the installation activities of PC girders, considering experiences of PC type bridge construction in Indonesia, experiences of which local contractors in the project areas have little, especially in NTB. The other types of superstructures and those construction methods are common in Indonesia.

(2) Schedule of Construction

i) Substructures

The substructures including foundations are constructed during the dry season, considering construction difficulties during the rainy season which is from December to March in NTT and NTB (4 months).

ii) Superstructures

Since both two (2) bridges in NTT are long bridges, construction of substructures will be scheduled to be undertaken during dry season and installation of girders during rainy season. Installation of PC girders, therefore, is to undertaken with erection girders applicable for swollen rivers during rainy season.

Since scales of all bridges in NTB are small and construction of each substructure requires short term, construction of superstructures during both rainy and dry seasons is possible devising implementation schedule. Bridges other than Tongoloka Bridge are to be constructed by installing of supports within river during dry season because of no or little water flow. RC type and RC flat slab type bridges, particularly, can be constructed during dry season after completion of substructures with all staging method which is low cost and simple, since construction period of them is very short. As far as some PC girder bridges are concerned, erection girder method for superstructure construction is applied for installation as well as construction in NTT, in case that all PC bridges can not be

constructed during dry season.

(3) Equipment for Construction

i) Capacity of Hauling Route

As access roads to the project sites having steep slopes, hairpin curves and badly damaged road surfaces, hauling large scale equipment is unreasonable and materials for the construction are limited in the length and weight. According to the site survey, the capacity of access roads to transport the equipment and materials are as follows:

- Vehicle for Hauling : Trucks with the deadweight of 10 tons
- Crane Truck : Rafter crane with the lifting capacity of 45 tons
- Maximum length of materials or equipment : 7.0 m

ii) Common Use of Equipment and Temporally Facilities

- Two (2) bridges in NTT: Equipment and temporally facilities cannot be used in common other than equipment for pile foundation works, for casting of PC girders and erection girders. Because; two (2) bridges are to be constructed around the same time; the road conditions of shortest route connecting two (2) bridges are not only badly damaged, but traffic is disrupted during rainy season due to swollen water flow; it will take long time to transport equipment between two (2) bridge sites, since the route passable through year, going through mountainous area, has poor geometry, badly damaged road surface and besides narrow road width.
- Nine (9) bridges in NTB : possible for common use because nine (9) bridges are located within 10 km and it is relatively easy to access to those sites in the section.

(4) Securing of Safety of Road Users and Construction Workers

i) Securing of Safety of Road Users

- To prevent road users from entering the project sites through clearly defining construction yard, and installing notice signs and barricade.

ii) Securing of Safety of Construction Workers

- To prevent construction workers engaging in works at high place from falling down by installing protect apparatus and prevention facilities.
- To take proper safety control and safety training for workers so as to avoid labor troubles derived from accidents and so on.

(5) Consideration on Natural / Social Environment

Prevention measures against water pollution caused by outflow of slurry are taken during

the construction of bored piles. All projected bridges are located within 1km from river mouth. But the impact to the ecosystem around the river mouth is less because the bottom of the sea is gravelly sand or rocks. The impact to the natural environment caused by the borrow pit and disposal area is less due to those small scale. However, it is carefully study during the selection of those locations. Disposal of wastes by the construction shall be followed the laws/regulations of Indonesia. As far as Menu Bridge and Fatuat Bridge the bridge length of which are longer than 60 m are concerned, monitoring during construction is to be carried out by Indonesia side through preparation of UKL and UPL. Agreement of land acquisition shall be taken from all people affected by the Project by the end of March of 2005, which was agreed upon between both sides.

To prevent the spread of HIV/AIDs, what local residents strongly fears, hygienic lectures shall be held periodically to the all staffs of the project including labors, and infection of HIV/AIDs shall be avoided.

2.2.4.3 Scope of Works

The undertakings of both governments, Japan and Indonesia are listed in Table 2.2.4-1(1). And Indonesia must maintain the work area in Table 2.2.4-1(2).

Table 2.2.4-1(1) Undertaking of Both Governments

Item	Contents	Undertaken by		Remarks
		Japan	Indonesia	
Procurement of materials and equipment	Procurement & delivery	○	-	
	Tax exemption & customs clearance	-	○	
	Maintenance/improvement of hauling route	-	○	
Preparatory works	Acquisition of lots for construction	-	○	Site office, stock yard, plant yard, working area, detour road at the construction sites etc.(see Table 2.2.4-1(2))
	Temporally support or strengthening of Tanaman II Bridge	○	-	
Removal / relocation of obstructions	Removal of surface obstructions	-	○	Electric posts and cables, telephone cables, etc.
	Removal of underground obstructions	-	○	Water pipes, etc.
Construction Works	Bridge new construction (10 bridges)	○	-	2 bridges in NTT 8 bridges in NTB
	Removal/replacement of the superstructure of Tabisu II Bridge	○	-	
	Development/construction of approach roads connecting bridges and existing roads	○	-	

Table 2.2.4-1 (2) Scale of Lot for Construction Works

	Stock & Office Yard			Casting Yard		
	Number of Places	Location	Area (m2)	Number of Places	Location	Area (m2)
NTT	2	Munu	11,765	2	Menu	3,150
		Fatuat	11,765		Fatuat	3,060
NTB	1	Puna I	11,765	4	Tanaman I	1,438
					Puna Ⅲ	1,036
					Tabisu I	1,069
					Tongoloka	1,394

2.2.4.4 Construction Supervision

A Japanese consultant will carry out the detailed design, assistance in tendering and construction supervision in accordance with the contract between the MOP and the consultant.

(1) Detailed Design

Major works in the detailed design to be carried out by the consultant are as follows:

- Consultation meeting for commencement between the MSRI and the consultant
- Site survey for the detailed design (Supplemental survey of site conditions and for construction planning/cost estimation, referring to the basic design)
- Detailed design of bridges including river bank protections and approach roads, and preparation of drawings.
- Preparation of construction plan, materials/equipment procurement plan.
- Preparation of cost estimation.
- Preparation of tender documents

(2) Assistance in Tendering

Major items of the services in the assistance related to tendering are as follows:

- Preparation of tender documents (conducted under the detailed design)
- Tender announcement
- Pre-qualification
- Assistance in tendering
- Tender evaluation
- Contract facilitation

(3) Construction Supervision

The consultant will carry out the supervision of the construction works executed by the contractor. The consultant will assign two (2) engineers for the supervision; one is for NTT

and the other for NTB. Major items of the construction supervision are as follows:

- Inspection and approval of the construction plan, schedule and construction drawings submitted by the contactor.
- Quality control
- Progress control
- Inspection of safety aspect
- Measurement of work
- Final inspection and turnover

2.2.4.5 Quality Control Plan

The quality control plan for concrete work is shown in Table 2.2.4-2 and for earthwork and pavement work in Table 2.2.4-3.

Table 2.2.4-2 Quality Control Plan for Concrete Work

Item	Test	Test method (Specification)	Frequency of Test
Cement	Physical property test	AASHTO M85	Once before trial mix. Thereafter, once every 10,000 bags or when the material brand is changed.
Fine Aggregate	Physical property test	AASHTO M6	Once before trial mix. Thereafter, when the quarry site is changed.
	Salt Testing	-	0.04% and below
Coarse Aggregate	Physical property test	AASHTO M80	Once before trial mix. Thereafter, when the quarry site is changed.
Water	Quality test	AASHTO T26	When the quarry site is changed.
Admixtures	Quality test	ASTM C494	Once before trial mix. Thereafter when the quarry site is changed.
Concrete	Slump test	AASHTO T119	One per 75 m^3 or one placement
	Air test	AASHTO T121	One per 75 m^3 or one placement
	Compressive strength test	AASHTO T22	6 specimens per placement or 6 specimens per 75m^3 when concrete volume in one placement is big, (3 specimens for 7 days strength test and 3 specimens for 28 days strength
	Chloride Content	Portable Tester authorized by JICE, Japan	According to need
	Temperature measurement	ASTM C1064	One per 75 m^3 or one placement

Table 2.2.4-3 Quality Control Plan for Earthwork and Pavement Work

Item	Test	Test Method (Specification)	Frequency of Test
Filled up ground	Moisture density relation	JIS A 1210	Once before placement and when the material source is changed.
	Density in-situ	JIS A 1214	Once every 1000 m^2
Roadbed	CBR	JIS A 1211	Once before placement and when the material source is changed.
	Moisture density relation	JIS A 1210	Once before placement and when the material source is changed.
	Density in-situ	JIS A 1214	Once every 500 m^2
Base Course / Sub-base Course	Sieve analysis	AASHTO T27	Once before placement and when the material source is changed.

Base Course / Sub-base Course	CBR	AASHTO T193	Once before placement and when the material source is changed.
	Moisture - density relation	AASHTO T180	Once before placement and when the material source is changed.
	Density in-situ	AASHTO T191	Once every 500 m^2
Gravel Surface Course	Sieve analysis	AASHTO T27	Once before placement and when the material source is changed.
Simplified Pavement (Penetration Type Macadam)	Physical property test of asphalt	JIS K 2207	Once before placement and when the material source is changed.
	Physical property test of asphalt emulsion	JIS K 2208	Once before placement and when the material source is changed.
	Physical property test of cutback asphalt	Japan Road Association	Once before placement and when the material source is changed.
	Sieve analysis	AASHTO T27	Once before placement and when the material source is changed.
	Screening sieve analysis	JIS A 5001	Once before placement and when the material source is changed.

2.2.4.6 Procurement Plan

(1) Construction Materials

Procurement plan of the major materials is shown in Table 2.2.4-4.

Table 2.2.4-4 Material Procurement Plan

Item	Procured from			Remarks
	Indonesia	Japan	Third Country	
1. Construction Material				
Cement	○	-	-	Normal Portland cement
Coarse Aggregate	○	-	-	Crushed stone
Fine Aggregate	○	-	-	Sand
Ready Mixed Concrete	○	-	-	
Admixture for Grouting	○	-	-	
Sub-base Course	○	-	-	Crushed stone
Base Course	○	-	-	
Reinforcing Steel Bar	○	-	-	Deformed bar
Prestressing Steel	○	-	-	Prestressing-steel strand (12.7mm)
High strength steel bar	○	-	-	
Anchorage of tendons	○	-	-	
Sheath	○	-	-	65mm
Expansion Joint	○	-	-	Steel slide plate
Bearing	○	-	-	Rubber bearing
Falling Protection Device	○	-	-	Anchor bar (ss400)
Cross Beam for Railing	○	-	-	Steel gas pipe + coat
2. Material for Temporary Works				
Plywood	○	-	-	For deck slab
Timber	○	-	-	For timbering

(2) Equipment

The equipment possible to be procured in Indonesia will be used, except for concrete

batching plants which are procured in Japan.

(3) Labors

Labors for construction works will be procured in Indonesia. However, as far as fabrication and installation works of PC girders are concerned, chief engineers will be procured in Japan or a third country because those works require well experienced skill.

2.2.4.7 Implementation Schedule

The Project is planned to be implemented in two (2) phases; Phase I is for the bridge construction in NTT and Phase II in NTB, the implementation schedule of which is shown in Table 2.2.4-5.

- Phase I (35 moths) : two (2) bridges (new construction) in NTT
- Phase II (32 months) : eight (8) bridges (new construction) and one (1) bridge (replacement of superstructure) in NTB

Table 2.2.4-5 Implementation Schedule

Phase	Province		Item	Month																						
				2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	
Phase I	NTT	D/D	Site Survey																							
			D/D																							
			Tendering																							
		Construction	Mobilization																							
			Substructure																							
			Superstructure																							
			Approach Road																							
			Revetment																							
			Demobilization																							
Phase II	NTB	D/D	Site Survey																							
			D/D																							
			Tendering																							
		Construction	Mobilization																							
			Substructure																							
			Superstructure																							
			Approach Road																							
			Revetment																							
			Demobilization																							

2.3 Obligation of the Republic of Indonesia

The following works should be undertaken by the GOI on condition that the grant aid by the GOJ is extended to the Project.

- To provide data and information necessary for implementing the Project.
- To secure the land necessary for the execution of the Project such as site offices, working areas, storage yards, plant facilities and others.
- To make it passable all roads and bridges leading to the Project sites before commencement of inland transportation of materials and equipment.
- To relocate existing utilities such as power poles, power cable, telephone and telecommunication cable, water pipes, etc.
- To bear commissions to the bank in Japan for its banking services based upon the Banking Arrangement, namely the advising commission of the "Authorization to Pay" and payment commission.
- To ensure prompt unloading, tax exemption, customs clearance at the port of disembarkation in Indonesia and prompt internal transportation of the materials and equipment for the Project.
- To exempt Japanese nationals engaged in the Project from customs duties, internal taxes and other fiscal levies, which may be imposed in Indonesia with respect to the supply of the products and services under the verified contract.
- To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the verified contract, such facilities as may be necessary for their entry into Indonesia and stay therein for the performance of their work.
- To provide necessary permission, licenses and other authorizations for implementing the Project.
- To prepare Environmental Management Plan (UKL) and Environmental Monitoring Plan (UPL) and to monitor the Project for Fatuat Bridge and Menu Bridge.
- To appropriately use and maintain bridges, roads, etc. after the completion of the Project.
- To coordinate and solve any issues related to the Project which may be raised from third parties or inhabitants in the Project area during implementation of the Project.
- To bear all the expenses, other than those covered by the Japan's grant aid, necessary for the Project.

2.4 Project Operation Plan

2.4.1 Operation and Maintenance System

The Project is not only to construct the bridges but include the construction of the approach roads and river bank protection. The maintenance for these facilities is essential in order to prolong their service life and maintain the facilities in good conditions, by which activities it follows that rehabilitation costs can be saved, and social and economic development will be facilitated.

In order to maintain the activities above, the appropriate operation and maintenance system shall be established and the budget shall be prepared. Both NTT and NTB, the governments of which are responsible for the development of the provincial roads, have sections related to the maintenance of roads and bridges, and have been securing the budget. It is necessary to confirm budgetary allocation necessary for maintenance, which was confirmed at the Minute of Discussion during this basic design stage, and appropriate maintenance activities by Indonesian side from the construction work stage.

2.4.2 Maintenance Work to be Done

The main structures such as main girders, cross beams and the deck slab of bridges to be constructed under the Project are concrete, which are basically free from the maintenance. However, as conditions of such structures and accessories as bearings, expansion joints, drainage system and river bank protection affect the rate of deterioration of main structures, it is recommended that the maintenance works be undertaken in accordance with the maintenance plan as follows:

(a) Routine Inspection

Bridge

- Pavement : crack, deformation, pothole, etc.
- Drainage : damage, presence of mud, debris, obstacle, etc.
- Bridge structure: damage on bridge surface, abutment, pier, bearing, expansion joint
- River bank protection: crack, damage, collapse, etc.
- Accessories: damage of railing, etc.

Approach Road

- Pavement: deformation, pothole, etc.
- Shoulder/slope: erosion, collapse, etc.
- Guide post: damage

(b) Daily Maintenance

- Drainage: cleaning
- Pavement: cleaning
- Expansion joint: cleaning
- Shoulder: cleaning, cutting grass
- Bridge: cleaning

(c) Routine Inspection

Bridge

- Structure: repair of damages
- Pavement: crack sealing, patching of potholes
- Drainage: repair of damages
- River bank protection: repair of damages
- Accessories: repair of damages

Approach Roads

- Pavement: patching of potholes, crack sealing, etc.
- Shoulder: repair of damages

2.5 Project Cost

2.5.1 Rough Estimate of Project Cost

The total project costs necessary for the Project are estimated at 1,742 Million Yen. The costs to be born by both governments, Japan and Indonesia, are based on the scope of works previously shown in Table 2.2.4-1, and respective details are estimated as follows, on the conditions shown in (3) below. This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

(1) Cost Born by the Government of Japan

Phase I	: approximately 945 Million Yen
Phase II	: approximately 791 Million Yen
Total Cost	: approximately 1,736 Million Yen

Table 2.5.1-1 Rough Estimate of Project Cost

Item			Roughly Estimated Cost (Million Yen)				
			Phase I (NTT)		Phase II (NTB)		Total
Facility	Bridge	PC & RC bridges, Cross Drainage, River Bank Protection	735	823	501	668	1,491
	Subsidiary Facilities	Approach Roads	88		166		
Detailed Design / Construction Supervision				122		123	245
Total				945		791	1,736

(2) Cost Born by the Government of Indonesia

Total Cost : 6 Million Yen (equivalent to IDR$_P$ 520 Million IDR$_P$)

(3) Conditions in Cost Estimate

- Exchange rate : 1 US Dollar = 110.56 Yen(average of previous six months until the end of August, 2004)
  : 1 IDR$_P$ = 0.01155 Yen (average of previous six months until the end of August, 2004)
- Construction period : implementation schedule as shown in Table 2.2.4-5
- Others : The Project is implemented in accordance with the system of Japan's Grant Aid.

2.5.2 Estimated Maintenance Cost

The annual cost for maintenance works undertaken by the government of East and West Nusa Tenggara Province is roughly estimated and shown in the Tables 2.5.2-1(1) and 2.5.2-1(2)

Table 2.5.2-1 (1) Maintenance Works and Cost (East Nusa Tenggara Province)

(a) Periodical Inspection

Location	Inspection Item	Frequency	Stuff	Tool & Equipment	Quantity	Cost (US$/Year)
Bridge		6 times a year Rainy Season 4 Dry Season 2 1 day/time	2 persons	Scoop, Hammer, Sickle, Pick-up Truck	Work force : 12 man-day/year Vehicle : 6 day/year	633
Pavement	Deformation, Surface Damage					
Drainage	Damage, Blockage					
Exp. Joint	Wear, Damage					
Shoe	Wear, Damage					
Hand Rail	Damage of Paint, Deform.					
Sub. Struc.	Damage					
Rivetment	Crack, Collapse					
Approach Road						
Pavement	Deformation, Surface Damage					
Shoulder	Erosion, Collapse					
Guide Post	Damage of Paint, Deform					

(b) Routine Works

Location	Inspection Item	Frequency	Stuff	Tool & Equipment	Quantity	Cost (US$/Year)
Bridge		4 times a year 4 days/time	5 persons	Scoop, Broom, Mowing Machine, Pick-up Truck	Work force : 80 man-day/year Vehicle : 32 day/year	4,070
Pavement	Cleaning					
Drainage	Cleaning					
Exp. Joint	Cleaning					
Shoe	Cleaning					
Sub. Struc.	Removal of Drift Wood, Mowing, Cleaning					
Approach Road						
Pave, Shoulder	Removal of Drift Wood, Mowing, Cleaning					

(c) Repair Works

Location	Inspection Item	Frequency	Stuff	Material & Equipment	Quantity	Cost (US$/Year)
Bridge		2 times a year 7 days/time	6 persons	Plate Tamper, Pick-up Truck, Gravel, Pipe, Asphalt, Boulder	Work force : 84 man-day/year Vehicle : 42 day/year Material Required	4,342
Structure	Damage Repair					
Pavement	Crack Seal, Pothole Seal					
Drainage	Damage Repair					
Hand Rail	Damage Repair					
Revetment	Damage Repair					
Approach Road						
Pavement	Crack Seal, Pothole Seal					
Shoulder	Damage Repair					

Total	9,045

Table 2.5.2-1 (2) Maintenance Works and Cost (East Nusa Tenggara Province)

(a) Periodical Inspection

Location	Inspection Item	Frequency	Stuff	Tool & Equipment	Quantity	Cost (US$/Year)
Bridge		6 times a year Rainy Season 4 Dry Season 2 1 day/time	2 persons	Scoop, Hammer, Sickle, Pick-up Truck	Work force : 12 man-day/year Vehicle : 6 day/year	633
Pavement	Deformation, Surface Damage					
Drainage	Damage, Blockage					
Exp. Joint	Wear, Damage					
Shoe	Wear, Damage					
Hand Rail	Damage of Paint, Deform.					
Sub. Struc.	Damage					
Rivetment	Crack, Collapse					
Approach Road						
Pavement	Deformation, Surface Damage					
Shoulder	Erosion, Collapse					
Guide Post	Damage of Paint, Deform					

(b) Routine Works

Location	Inspection Item	Frequency	Stuff	Tool & Equipment	Quantity	Cost (US$/Year)
Bridge		4 times a year 3 days/time	4 persons	Scoop, Broom, Mowing Machine, Pick-up Truck	Work force : 48 man-day/year Vehicle : 24 day/year	2,442
Pavement	Cleaning					
Drainage	Cleaning					
Exp. Joint	Cleaning					
Shoe	Cleaning					
Sub. Struc.	Removal of Drift Wood, Mowing, Cleaning					
Approach Road						
Pave, Shoulder	Removal of Drift Wood, Mowing, Cleaning					

(c) Repair Works

Location	Inspection Item	Frequency	Stuff	Material & Equipment	Quantity	Cost (US$/Year)
Bridge		2 times a year 5 days/time	5 persons	Plate Tamper, Pick-up Truck, Gravel, Pipe, Asphalt, Boulder	Work force : 50 man-day/year Vehicle : 20 day/year Material Required	2,623
Structure	Damage Repair					
Pavement	Crack Seal, Pothole Seal					
Drainage	Damage Repair					
Hand Rail	Damage Repair					
Revetment	Damage Repair					
Approach Road						
Pavement	Crack Seal, Pothole Seal					
Shoulder	Damage Repair					

Total	5,698

2.6 Other Relevant Issues

As access roads to the project sites in both provinces are in poor conditions (road surface, geometry and road width), development of the roads by Indonesian side connected with bridge construction by Japan side is essential in order to smoothly implement the Project and sustain and enhance the effects of the Project. Hence, the GOI shall take the following issues into consideration in the implementation of this Project.

Common Issues in Both Provinces

- To secure land required for the Project through adequate compensation.
- To conduct adequate maintenance after the bridge construction.
- To implement rehabilitation and development including proper pavement of roads complying with the Minutes of Discussion agreed upon in this basic design stage.

Issues in NTT

- To connect missing provincial road of the west side of Menu Bridge.

Issues in NTB

- It is essential to complete the development of the south ring road (Sejorong - Lunyul section) in order to sustain and enhance the effects of the Project. High priority shall be given to the development and restoration of the section between Togoloka and Mone (nearest transmigration area) where there are impassable portions due to landslides and scouring of river and so on.

It is necessary to monitor the status of the budgetary allocation by Indonesia side so that the road development mentioned above is certainly implemented.

Chapter 3 Project Evaluation and Recommendations

3.1 Project Effects

The following effects are expected through the implementation of the Project.

(1) Direct Effects

(a) Improvement of Traffic Function

- Traffic function as an arterial road will be improved by securing the year-round traffic through elimination of impassable sections and periods during the rainy season.

(b) Shortening of Traveling Time

- Traveling time between major cities or villages will be significantly shortened by constructing bridges crossing over the rivers that have been difficult to cross over.
- Smooth and comfortable driving at river crossing can be expected.

(c) Efficiency of Cargo Transportation

- Efficiency of cargo transportation can be expected through construction of the proposed bridges and access roads with smooth alignment at river crossing where it has been extremely difficult for cargo tracks to cross over.

(2) Indirect Effects

(a) Promotion of Distribution of Goods and Communication of People

- Through the improved traffic function as an arterial road, the following effects can be expected: smooth distribution of goods such as agricultural, fishery and stock farm products will be secured: communication of people and transmigration plan will be promoted.

(b) Revitalization in Social and Regional Economic Activities

- Revitalization of social and regional economic activities will result from the improvement of living conditions through promotion of distribution of goods and communication of people.

3.2 Recommendations

The following are the issues that the GOI should cope with in order to enhance and sustain the project effects.

(1) Fulfillment of Obligations of the GOI

The GOI shall fulfill obligation mentioned in Chapter 2 (2.3). It is particularly required that the GOI shall complete land acquisition necessary for approach road sections by the approval of Cabinet Council of Japan.

(2) Implementation of Road Development Plan

The GOI has a plan to develop the provincial roads where the project bridges are located; both provincial roads are expected to function as only trunk roads alternative to the national roads. Scope of the road development plan is as follows: restoration of damaged portion, widening, improvement of poor geometry, installation of box culvert in small rivers and so on.

The road developments will be implemented according to the following schedule.

- NTT: Section between Wainbesak and Batuputih (2005 - 2008)
- NTB: Section of the south ring road between Sejorong and Lunyuk (2005 - 2012)

The above road developments are so effective to enhance the project validity that the certain implementation of them is expected.

The proposed nine (9) bridges in NTB are located on the south ring road (Sejorong-Lunyuk) where the transmigration has been promoted by the GOI. Through this Project, year-round traffic will be secured in the western section of the ring road. Though the ring road was once completed in 2002, there are impassable portions in the central sections due to landslides and scouring of river in mountainous area. The GOI is again to implement the development and restoration of the ring road mentioned earlier; topographic survey was already carried out (September 2004 to July 2005); however, as for bridge construction except some small bridges, there is no prospect of it.

According to the above circumstances, in NTB bridge construction connected with the road development by Indonesia side is an issue to enhance the project effects. As far as construction of moderate or small bridges is concerned, the request to the GOJ was made as Phase II.

(3) Conduction of Appropriate Maintenance

Main maintenance activities for the bridges constructed under this project are routine and periodic inspections and rehabilitation of bridges and approach roads, estimated costs of which are 88 million Rp. per year for NTT, 55 million Rp. per year for NTB. These costs will not be hard for the GOI to bear considering the costs are 0.2 % to 0.3 % of annual budget for road and bridge maintenance as shown in Table 3.2-1. It is recommended in terms of efficient and economical maintenance that the periodic inspection and easy or small repair be carried out under contract with residents or NGO in the vicinity of the project area. This will save maintenance costs and be able to early detect the deficiency or damages of the structures because they usually use the road and necessary costs for their activities are much cheaper than that for contractors.

Table 3.2-1 Budget for Road and Bridge Maintenance in NTT and NTB

	Year 2004		Year 2005	
	Budget	Ratio of Maintenance Costs for the Project to Budget	Budget	Ratio of Maintenance Costs for the Project to Budget
NTT	29,013	0.3 %	40,400	0.2 %
NTB	27,343	0.2 %	25,742	0.2 %

Unit: million Rp.