Directorate General of Highways
Ministry of Public Works
Republic of Indonesia

PREPARATORY SURVEY
ON
THE PROJECT FOR CONSTRUCTION OF BRIDGES IN THE PROVINCE OF NUSA TENGGARA BARAT PHASE-3
IN
THE REPUBLIC OF INDONESIA

February 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
KATAHIRA & ENGINEERS INTERNATIONAL

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Katahira & Engineers International on the Project for the Construction of Bridges in the Province of Nusa Tenggara Barat, Phase-3 in the Republic of Indonesia.

The survey team held a series of discussions with the officials concerned of the Government of the republic of Indonesia, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

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

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

February, 2012

Kiyofumi Konishi
Director General,
Economic Infrastructure Department
Japan International Cooperation Agency

Summary

1. Outline of the Country

The country of Indonesia is composed of approximately 18,000 islands. It is the world's largest archipelagic country. With a population of 231,369,000 people in 2009, it is the world's fourth most populous country. Indonesia is the world's 16th largest country in terms of country area with a area of about 1,860,000 square kilometers. Indonesia has extensive natural resources, including crude oil, natural gas, tin, copper, and gold. Major agricultural products include rubber, rice, palm oil.

The province of Nusa Tenggara Barat (NTB), which is located at the east of Jawa Island, is composed of Lombok Island, Sumbawa Island and other islands. The provincial capital is Mataram City which is located in Lombok Island. The Sumbawa Island area is approximately 15,000 square kilometers and about 1,200,000 population which is located at the east of Lombok Island.

Sumbawa Island belongs to tropical climate. The temperature does not vary much throughout the years. The monthly mean maximum temperature is 34.3℃, the monthly mean minimum temperature is 19.9℃ and the average yearly temperature is 26.8℃ in 2006. The rainy season is from November to April, and the dry season is May to October. The average annual rainfall is 1300mm in the last 10 years. Since the topography is mountainous, the rainwater discharges rapidly after the rainfall. A weather station is located in Lunyuk in the project area.

Indonesia was the country hardest hit by the East Asian monetary crisis in late 1990s. However, the economy has recovered significantly through an economic reform. GDP growth exceeded 5% since middle of 2000s. The growth rate, however, is not enough to make a significant impact on unemployment and stagnant wages growth. Increases in fuel and rice prices have worsened poverty levels. Indonesia still struggles with poverty and unemployment, inadequate infrastructure, corruption, a complex regulatory environment, and unequal resource distribution among regions. The government faces the ongoing challenge of improving Indonesia's insufficient infrastructure to remove impediments to economic growth.

2. Background of the Project

The province of Nusa Tenggara Barat (NTB) is consisted of Lombok, Sumbawa and other several islands which are located in the east of Jawa Island. The socioeconomic development of NTB has been left behind in the development of Indonesia. The mitigation of the regional economic imbalance is a major objective for the national development of Indonesia. Sumbawa

Island with a population of about 1.2 million has high potential of agriculture, mining, fishery and tourism in the southern area; therefore, transmigration from surrounding islands has been promoted.

In Sumbawa Island, a national road running from Tano Port in the west through the biggest town Sumbawa Besar to the east end of the island along the north coast is the only 2-lane paved road which carries most of the freight transportation in the island. Other roads are not in good condition and obstructing the development of the island. There is a provincial road connecting southern area with the national road from Tano to Sumbawa Besar. The northern national road together with the southern provincial roads forms a ring road which encircles Sumbawa Island. The ring road was opened in 2002 only with temporary spillway bridges. They are not passable when the rivers are deep and the spillways made of gabions have already been broken or washed away. Presently, the southern section of the ring road is impassable for motor vehicles, except for the flat terrain section near Lunyuk. Therefore, people and goods in the eastern and western sides of the southern Sumbawa Island cannot be transported from one side to the other. The improvement of the road condition in the southern section of the ring road is crucial for the development of the southern area and the promotion of the transmigration.

With these circumstances, the Government of Indonesia (GOI) and the Provincial Government of Nusa Tenggara Barat (NTB) have envisioned to open the south ring road from Sejorong to Lunyuk and commenced improvement of the road including construction of small bridges. To construct relatively large bridges, the GOI requested the Government of Japan (GOJ) for the grant aid assistance due to the technical and financial constraints. In response to the request, the GOJ extended the grant aid assistance for the construction of bridges in the following two phases:

Phase-1: Construction of 8 bridges in Sejorong - Tongoloka Section completed in March 2009
Phase-2: Construction of 4 bridges in Tongoloka – Tatar (17km from Tongoloka) Section completed in November 2011.

There still remain 11 bridges in Tatar – Lunyk Section (Phase-3 Section) which were surveyed and proposed to be constructed under Japan’s grant aid in the Basic Design Study on the Project for Construction of Bridges in the Province of Nusa Tenggara Barat Phase-2 (hereinafter referred to as “the Basic Design Study”) conducted by Japan International Cooperation Agency (JICA) in 2008. The basic design of the bridges and the implementation schedule of the Phase-3 of the Project were prepared in the Basic Design Study.

This Preparatory Survey aims to identify the present site conditions and to survey the latest procurement conditions of equipment and materials in order to update the Project cost and the implementation schedule.

3. Outlines of the Survey Results and Contents of the Project

JICA sent the Preparatory Survey Team from November 13 to 25, 2008 in order to confirm the present project site conditions and survey the latest procurement conditions of construction materials and equipments and to make discussions with the concerned officials of the Government of Indonesia. On their return to Japan, the outline design of the bridge facilities and the project implementation plan were reviewed and updated, and a draft final report was prepared and sent to Indonesia. The final report was prepared reflecting the comments from the Indonesian side.

This project aims to construct 10 bridges along the project road section between Tatar and Lunyuk (about 45 km) which is a part of Sumbawa Island Ring Road.

The design policy employed for the outline design of the Project bridges is as follows:

Design review based on the Project site condition changes

- BR-27 Liang Bagik Bridge has been constructed by Indonesian side, therefore, it is excluded from the Project bridge list.
- River condition of BR-13 and BR-27 has been changed. Additional riverbank protections were planned to be installed as the countermeasure against future river condition change.
- In constructing bridges in Phase-2 of the Project, the length of steel tubular piles was extended from the design one because the piles were unable to gain the expected bearing force with it. To avoid the same problem in this Project, the tubular pile lengths are reviewed.

Scope of the Japanese Assistance

The scope of the Japanese assistance covers the following works:

- Construction of bridge structures.
- Approach roads (Minimal length to connect the new bridge with the existing road).
- Abutment protections, riverbank protections, abutment protections (Minimal areas to protect the new bridges).
- Temporary detour road (if necessary for the new bridge construction).

Design standards

The design specifications issued by the Directorate General of Highway, Ministry of Public Works, Indonesia are basically adopted for the design of bridges and approach roads.

Selection of transportable material and equipment

Padas Port in Sumbawa Besar has enough capacity for landing large-sized goods. However,

there are mountainous road sections between the port and the project site that makes transportation of large-sized materials and equipment by semi-trailer difficult. Construction materials and equipments which are transportable by trucks are scheduled to be used.

Easy and safe Construction

Safe construction methods are adopted. RC girder type is adopted for the bridges shorter than 20m. Plate girder type, of which materials are small and light, is adopted for the bridges longer than 20m instead of PC girder type which is long and heavy. The cost and required-maintenance of the both types are almost same.

Cost Efficiency

All materials including plate girders are procured from local. “Integral type” structure is adopted for all bridges since this type bridge memebers can be small size and the cost becomes less. The bridges in the mountain section are single lane since the traffic is small and the running speed is slow. Widening will be undertaken by Indonesian side when necessary. However, the widened foundation is constructed in this project since the widenig of the foundations is difficult and costly.

Maintenance-free

Required maintenance for the bridges should be minimized since the site is located in a remote area. No expansion joints and bearings which require frequent maintenance is necessary for the integral type bridges. The plate girders are galvanized. The concrete covers of the bridges near sea are enlarged to protect the bridges from salt.

Bridge planning reflecting site conditions

Bridge layouts are developed considering the river condition, geological condition and other site conditions.

Provision of sidewalk

Indonesian standard width (50 cm) sidewalks are provided for the bridges where pedestrian traffic is surveyed.

The project bridges are planned on the basis of the above policies. The components of the project bridge facilities are as summarized in the following table.

Components of the Project Bridge Facilities

No	Bridge No.	Bridge Name	Bridge Length (m)	Carriageway Width (m)	Superstructure Type	Foundation Type	Approach Road Length (m)
1	BR-13	Mone I	20.0	4.5	RC Girder	Spread Footing	109.5
2	BR-16	Telonang I	50.0	4.5	Plate Girder	Steel Tubular Pile	119.5
3	BR-19	Sepang	40.0	4.5	Plate Girder	Steel Tubular Pile	148.0
4	BR-20	Bontong	20.0	4.5	RC Girder	Spread Footing	130.0
5	BR-22	Blengkon	20.0	4.5	RC Girder	Spread Footing	120.0
6	BR-27	Lamar	55.0	6.0	Plate Girder	Steel Tubular Pile + Shallow Caisson	149.7
7	BR-32	Petain III	20.0	6.0	RC Girder	Spread Footing	108.9
8	BR-33	Molong	20.0	6.0	RC Girder	Spread Footing	140.0
9	BR-34	Emang	45.0	6.0	Plate Girder	Steel Tubular Pile	97.8
10	BR-35	Kalbir	25.0	6.0	Plate Girder	Steel Tubular Pile	97.3
Total			315.0	—	—	—	1220.7

4. Project Period and Rough Cost Estimate

In case the project is implemented, the detailed design will take 4.0 months and the construction will take 20.0 months. The Project will be implemented in accordance with the Japan's Grant Aid scheme and the cost will be determined before concluding the Exchange of Notes (E/N) for the Project.

5. Project Evaluation

The direct beneficiaries of the project are the residents in the southern Sumbawa Island with a population of approximately 120,000 people, whereas the indirect beneficiaries are the people of Sumbawa Island (Approximately 1,200,000).

(1) Quantitative Effects

- Presently, common vehicles (2-wheel drive vehicles) cannot pass through the Sumbawa South Ring Road due to lack of bridges and bad road condition. It will be passable for common vehicles all throughout the years after the project. (The passable duration becomes 12 month from zero per year.)
- Presently it takes about 4 hours 30 minutes to drive from Tongoloka to Lunyuk (about 60 km) by a 4-wheel vehicle. It will be about 3 hours after the project.

(2) Qualitative Effects

- People in the southern Sumbawa can travel easily and transport goods effectively with the improvement of the bridges and road. This will activate socio-economic activities in the area that will raise the living standards of the people. In other word, the project will contribute to the socio-economic development of the areas.

- The improvement of the living standards of the transmigrated areas will result the increase of the transmigration and development of the areas. As the result, the project will contribute to the success of the transmigration programs.

- When a road is closed by a disaster in the northern area, the traffic can go to the destination by detouring to the south ring road (the project road).

6. Recommendations

Since the project will make significant effects as mentioned above and subsequently contribute to the improvement of the residents' living condition, the project will be worth being implemented under the Japan's grant aid. In order to realize, enlarge and sustain the effects of the Project, responsibilities to be undertaken by the Indonesian side are as follows:

- To make Sumbawa South Ring Road passable for common vehicles, pavement of steep road sections, construction of remaining small bridges and repair of road and drainage along the Project road are necessary. These works should be undertaken by Indonesian side before the completion of the Project.

- To adequately carry out maintenance and repair works to keep the road and bridges in good condition and in order to maximize their serviceable lives.

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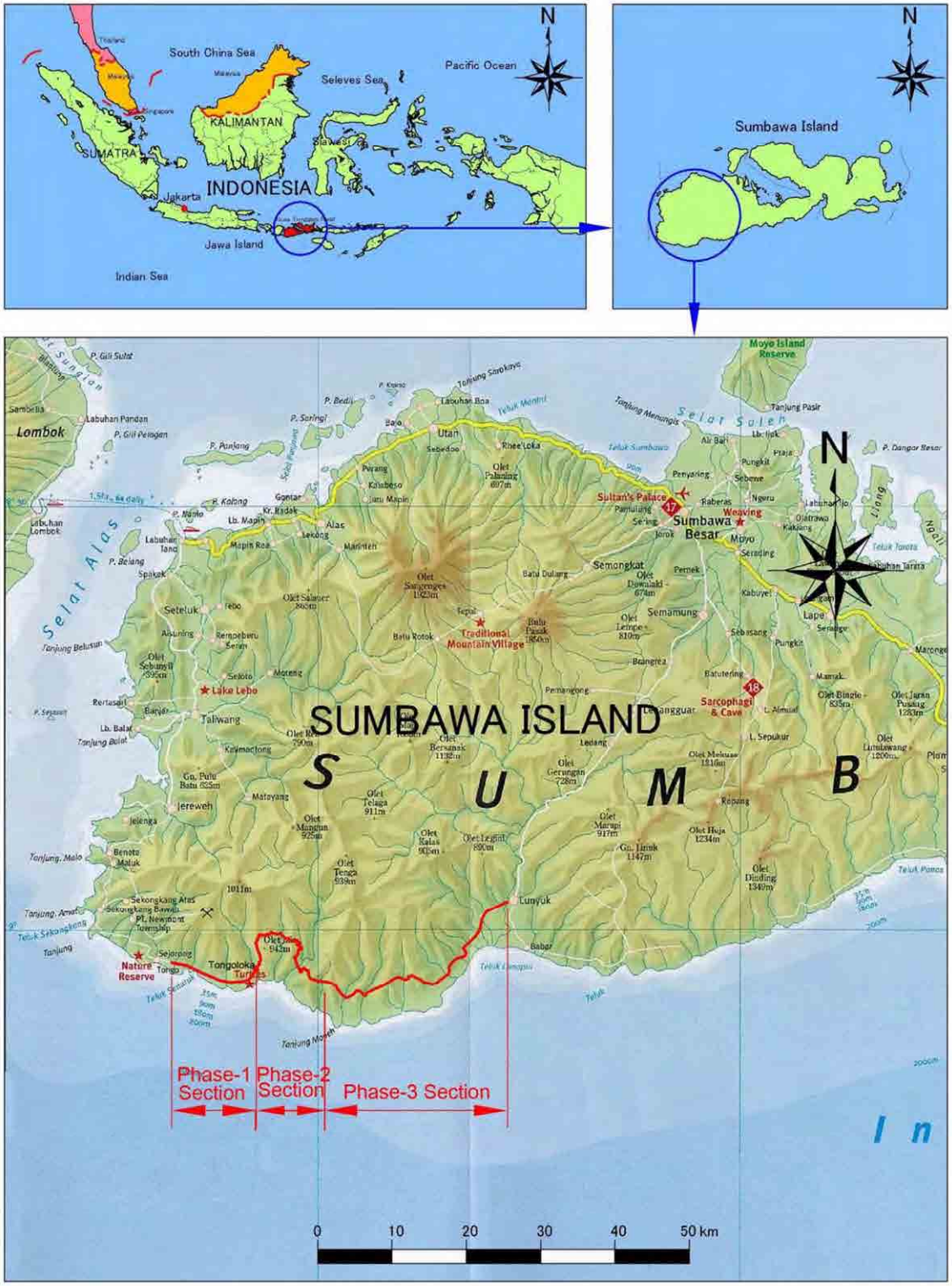

LOCATION MAP

BRIDGE LOCATION MAP

PERSPECTIVE (BR-8 Tatar Loka Bridge)

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Abbreviations

AASHTO	: American Association of State Highway and Transport Officials
BLHP	: Provincial Environmental Management Office (Badan Lingkungan Hidap dan Penelitan)
BAPPEDA	: Regional Development Planning Agency) (Badan Perencanaan Pembangunan Daerah)
DGH	: Directorate General of Highways
E/N	: Exchange of Note
GDP	: Gross Domestic Products
GOI	: Government of Indonesia
GOJ	: Government of Japan
GRDP	: Gross Regional Domestic Products
JICA	: Japan International Cooperation Agency
JIS	: Japan Industrial Standards
M/D	: Minutes of Discussions
MPW	: Ministry of Public Works
NTB	: Nusa Tenggara Barat
ODA	: Official Development Aid
PAPs	: Project Affected Persons
PC	: Prestressed Concrete
RC	: Reinforced Concrete
ROW	: Right-of-Way
Rp	: Rupiah (Indonesian currency)
Sta.	: Station
UKL	: Environmental Management Measures (Upaya Pengelolaan Lingkungan Hidup)
UPL	: Environmental Monitoring Measures (Upaya Pemantauan Lingkungan Hidup)

CHAPTER 1 BACKGROUND OF THE PROJECT

1.1 BACKGROUND, HISTORY AND OUTLINE OF THE PROJECT

The province of Nusa Tenggara Barat (NTB) is consisted of Lombok, Sumbawa and other several islands which are located in the east of Jawa Island. The socioeconomic development of NTB has been left behind in the development of Indonesia. The mitigation of the regional economic imbalance is a major objective for the national development of Indonesia. Sumbawa Island with a population of about 1.2 million has high potential of agriculture, mining, fishery and tourism in the southern area; therefore, transmigration from surrounding islands has been promoted.

In Sumbawa Island, a national road running from Tano Port in the west through the biggest town Sumbawa Besar to the east end of the island along the north coast is the only 2-lane paved road which carries most of the freight transportation in the island. Other roads are not in good condition and obstructing the development of the island. There is a provincial road connecting southern area with the national road from Tano to Sumbawa Besar. The northern national road together with the southern provincial roads forms a ring road which encircles Sumbawa Island. The ring road was opened in 2002 only with temporary spillway bridges. They are not passable when the rivers are deep and the spillways made of gabions have already been broken or washed away. Presently, the southern section of the ring road is impassable for motor vehicles, except for the flat terrain section near Lunyuk. Therefore, people and goods in the eastern and western sides of the southern Sumbawa Island cannot be transported from one side to the other. The improvement of the road condition in the southern section of the ring road is crucial for the development of the southern area and the promotion of the transmigration.

With these circumstances, the Government of Indonesia (GOI) and the Provincial Government of Nusa Tenggara Barat (NTB) have envisioned to open the south ring road from Sejorong to Lunyuk and commenced improvement of the road including construction of small bridges. To construct relatively large bridges, the GOI requested the Government of Japan (GOJ) for the grant aid assistance due to the technical and financial constraints. In response to the request, the GOJ extended the grant aid assistance for the construction of bridges in the following two phases:

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This Preparatory Survey aims to identify the present site conditions and to survey the latest procurement conditions of equipment and materials in order to update the Project cost and the implementation schedule.

1.2 PRESENT SITE CONDITION SURVEY RESULT

(1) Present Condition of the Project Bridge Sites

The bridge site condition survey for the Preparatory Survey was conducted in November 2011 in order to identify the present site conditions. The major survey items are conditions of river and bridge approach roads because such changes require revision of structure or location of the bridges. The survey result is shown in Table 1.2-1.

Table 1.2-1 Present Condition of the Project Bridge Sites

Bridge	Changes since Basic Design Study	Site Photograph
BR-13 Mone I	The river at upstream of the site was severely eroded by floods. The riverbank erosion is progressing. However, the river alignment will not change very much because the both sides of the river is surrounded by rocky mountains.	
BR-16 Telonang I	No significant change	
BR-19 Sepang	No significant change	
BR-22 Bontong	No significant change	
BR-23 Blengkon	No significant change	

BR-27 Lamar	Large scale quarrying of gravel from the river is being executed. Due to the quarrying, river alignment has changed and riverbank erosion has been occurred.	
BR-29 Liang Bagik	New RC bridge has been constructed.	
BR-32 Petain III	No significant change	
BR-33 Molong	No significant change	
BR-34 Emang	No significant change	
BR-35 Kalbir	No significant change. Relocation of power poles has been completed.	

(2) Progress of the Project Road Improvement

The Project road improvement works as shown in Table 1.2-2 were agreed to be undertaken by Indonesian side as described in the Basic Design Study Report. The progress of the works as of November 2011 is as shown in Table 1.2-2.

Table 1.2-2 Progress of Project Road Improvement (Undertaking of Indonesian Side)

Works	Responsible Organization	Original Schedule	Progress
Construction of 20 Small Bridges	NTB Provincial Government	2009-2010	14 Bridges have been constructed. 6 bridges have not yet been constructed.
Road Improvement of 15 km (Sta.17km-Sta.32km)	Ministry of Public Works	2009	Work has been done. However, pavement at very steep sections and repair of the road are necessary.
Road Repair and Maintenance of 28 km (Sta.32km-Sta.60km)	NTB Provincial Government	2009-2010	Hot mix asphalt pavement for 25km is ongoing with schedule to be completed by 2013 (Sta.35km - Sta.60km)

(3) Present Condition of Sumbawa South Ring Road

Sumbawa South Ring Road (provincial road) is connected with Maluk where mining factory located at the southwest of the island and Sumbawa Besar the biggest town in the island at the northern coast. The present condition of Sumbawa South Ring Road is summarized as shown in Table 1.2-3. The road map is shown in Figure 1.2-1.

Table 1.2-3 Present Condition of Sumbawa South Ring Road

Section	Section Length (km)	Road Surface Type	Road Condition
Maluk – Sejorong	25	BST / AC (ongoing)	Fair condition. All section is paved. AC pavement work is ongoing.
Sejorong – Tongloka (Phase-1 Section)	20	Gravel	Fair condition. Driving is smooth since the terrain is flat.
Tongoloka – Tatar (Phase-2 Section)	15	Gravel	Fair condition. Steep sections are paved with BST.
Tatar – Blengkon (Phase-3 Section)	20	Gravel	Fair/Bad condition. Steep section is not paved. There are rough spots due to lack of drainage.
Blengkon – Lunyk (Phase-3 Section)	25	Gravel / AC (ongoing)	AC pavement work for all section is ongoing.
Lunyk – Sumbawa Besar	100	BST	Fair condition. All section is paved. Driving is smooth.

Note; AC: Asphalt concrete pavement, BST: Bituminous surface treatment

(4) Transmigration Areas along the Project Road

There are transmigration areas along the Project road as shown in Table 1.2-4 and Figure 1.2-1. It is seen that farming areas are expanding by reclamation of the forest along the Project road. New transmigration area was opened at Tong II in 2009 and additional transmigration is planned to be opened at Lamar in 2012 along the Project road.

Table 1.2-4 Transmigration Areas along the Project Road

Location	Transmigration Area	Household (Population)	Opening Year
West Sumbawa Regency	Telonang	258 (1,392)	2006
	Tong II	402 (1,726)	2009
Sumbawa Regency	Bontong	174 (829)	2006
	Sampargoal	300 (860)	2006
	Lamar	210 (840)	2012（Plan）
	Total	1,344 (5,647)	

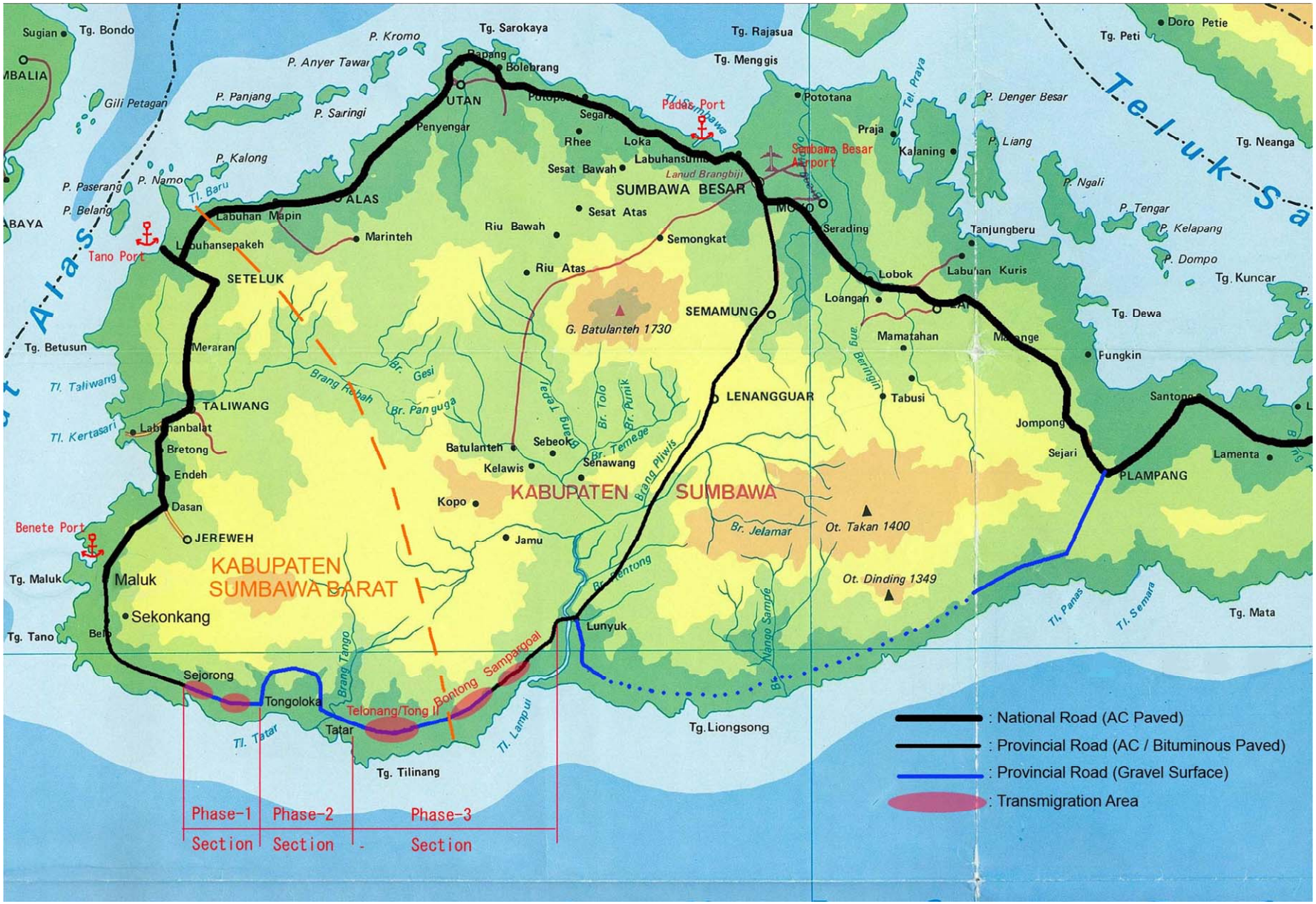


Figure 1.2-1 Sumbawa South Ring Road Map

CHAPTER 2 CONTENTS OF THE PROJECT

2.1 BAISC CONCEPT OF THE PROJECT

2.1.1 Overall Goal and Project Purpose

(1) Overall Goal

One of the major objectives of the National Medium-Term Development Plan (2004-2009) is to mitigate improper disparity in the development of Java Island compared to the other islands, western regions to eastern regions and urban areas to rural areas. As a measure to realize the objectives, it is emphasized to spur the development of infrastructures in those underdeveloped regions and areas. The Ministry of Public Works emphasizes the following strategies in its road development policy:

- To develop infrastructures that boost up economic activities in the underdeveloped regions
- To provide roads that may reach isolated and remote areas
- To support provincial governments in constructing roads and bridges
- To support the policy of transmigration from overpopulated areas to underdeveloped areas

The present National Medium-Term Development Plan (2010-2014) aims to realize more social welfare, democracy and justice through development of economy, development of natural and human resources, decrease unemployment and poverty and development of infrastructures. The Ministry of Public Works supports the above national goal through development of infrastructures including construction of comprehensive nationwide road network.

(2) Project Purpose

The major purposes of the project are as follows:

- To provide an efficient and effective road network in Sumbawa Island by completing the connecting ring road
- To provide safe, efficient and effective transportation means for Sumbawa southern area
- To support the transmigration program by constructing roads in the transmigration areas

2.1.2 Outline of the Project

This project aims to construct 10 bridges along the Project road section between Tatar (15 km from Tongoloka) and Lunyuk (the road section length about 45 km) which is a part of Sumbawa South Ring Road. The project bridges are relatively large size bridges (longer than 20m) among river crossings along the Project road. The location of the Project bridges is shown in the location map at the begging of this report. The small bridges (shorter than 20m) along the Project road are to be constructed by Indonesian side.

2.2 BASIC CONCEPT OF THE REQUESTED JAPANESE ASSISTANCE

2.2.1 Design Concepts of the Project

2.2.1.1 Design Concepts of the Preparatory Survey

(1) Purpose of the Preparatory Survey

As a result that Basic Design Study of this Project which was conducted in 2008, 4 bridges were proposed for Phase-2 and 11 bridges were proposed for Phase-3 of the Project. The outline design of the Project bridges was prepared in the Basic Design Study. Phase-2 of the Project was implemented from 2010 to 2011. Consequently, to implement Phase-3 of the Project, this Preparatory Survey is conducted for identifying the present site conditions and surveying the latest procurement conditions of equipment and materials in order to update the Project cost and the implementation schedule.

(2) Project Bridges

Among the 11 bridges previously proposed for Phase-3 of the Project, BR-29 Liang Bagik Bridge has already been constructed by Indonesian side. Therefore, the remaining 10 bridges are finally proposed to be constructed under Phase-3 of the Project. The list of the Project bridges is as shown in Table 2.2-1.

Table 2.2-1 Project Bridge List

No.	Bridge No.	Bridge Name
1	BR-13	Mone I
2	BR-16	Telonang I
3	BR-19	Sepang
4	BR-20	Bontong
5	BR-22	Blengkon
6	BR-27	Lamar
7	BR-32	Petain III
8	BR-33	Molong
9	BR-34	Emang
10	BR-35	Kalbir

(3) Outline Design Update Policy

Basically, the outline design of the Project bridges prepared in Basic Design Study is not revised, except the following two changes.

Countermeasure against Site Condition Change:

The river conditions have been changed from those surveyed in the Basic Design Study at BR-13 and BR-27 as explained in Section 1.2. Countermeasure against the river condition change is studied and reflected in the basic design of the bridges.

Feedback of Experience in Previous Phase

In constructing bridges in Phase-2 of the Project, the lengths of steel tubular piles were extended from the design ones because the piles were unable to gain the expected bearing force. To avoid the same problem in this Project, the tubular pile lengths are reviewed.

(4) Design Concepts employed in the Basic Design

The major design concepts employed in the outline design of the Project bridges are as follows:

Scope of the Japanese Assistance

The scope of the Project covered by Japan’s grant aid is the following work:

- Construction of bridge structures
- Approach roads (Minimal length to connect the new bridge with the existing road)

- Abutment protections, riverbank protections, abutment protections (Minimal areas to protect the new bridges)
- Temporary detour road (if necessary for the new bridge construction)

Design Standards/Specifications

The design specifications issued by the Directorate General of Highway, Ministry of Public Works, Indonesia are basically adopted for the design of bridges and approach roads. AASHTO and Japanese specifications are adopted supplementary.

Consideration for Natural Conditions

In the bridge planning and designing, the natural site conditions such as topographical condition, geological condition, river condition, seismic condition are taken into consideration. The design flood levels are determined by comparison between the floods levels obtained from hearing / observation survey and from hydraulic analysis with 50-year period probability. The bridges close to the sea should be considered counter-measures against salt damage.

Consideration for Socio-economic condition

The bridge widths are determined by taking the present and future traffic volume and traffic composition into consideration. The road width, the pavement structures and the geometric standards of the bridge approach roads are designed by taking the traffic condition of the sites into consideration.

Consideration for Construction and Procurement Conditions

Local materials and local products are utilized at optimum. Materials are selected by comparing their quality, cost and procurement possibility. Efficient construction plan is prepared by taking the availability of local materials, machines, labors, and so on into consideration.

Operation and Maintenance Policy

After the completion of the Project, the bridges will be maintained under the provincial government’s road and bridge maintenance system. However, the bridge is designed to be maintenance-free as much as possible.

Policy on Facilities Grading

The grading (standards) of the bridges and approach roads are determined referring to

the design standards / criteria established by the Ministry of Public Works of Indonesia, of which the standards for provincial roads are basically adopted. However, the design standards proposed for the facilities are referring to the Japanese design standards and AASHTO. Also, the design standards adopted in the previous phases of the project are referred to.

Policy on Construction Method Planning

To plan the construction easily and smoothly, the common construction methods using common materials and technique are adopted. To secure the construction quality, the required specifications of the material quality tests and as-built measurement inspection are clearly written in the contract documents and technical specifications. The construction plan is prepared by taking safety of the surrounding residents and construction staff and environment into considerations. Detour roads are provided during the construction.

Policy on Environmental and Social Consideration

As this project is to construct bridges along the existing road, therefore, it will not change the natural environment conditions. However, the followings are considered in the design and construction planning to minimize the effects on the environmental and social conditions.

- Complying to the environmental law and regulations to obtain the construction permit and JICA guideline.
- Avoiding land acquisition and removal of houses in selection of new bridge location
- Minimizing relocation of utilities and obstacles in road alignment planning
- Minimizing the inconvenience for traffic by providing temporary detours
- Controlling vibration and noise in the vicinity of residential area
- Treating the construction disposals properly

Policy on Cost Efficiency

The bridge facilities are designed with the top priority to secure the required functions and durability. However, cost efficiency will also be considered in the design. The major items to be considered are as follows:

- Materials are selected on cost comparison including local materials.
- Construction methods are proposed on cost comparison of schemes including

utilizing local materials and equipments.

- The facility capacity is determined in anticipation to the present and future use.
- Materials for protections, retaining walls, ditches should be from economic and locally available materials.
- Up-to-date design method is adopted in structural design.

2.2.1.2 Design Standards and Specifications

Design standards and specifications adopted in the outline design of the Project bridges are as follows:

Design Criteria

- Live load: Design vehicle loads as specified in the specifications issued by the Ministry of Public Works, Indonesia
- Temperature change：±15℃ (15 - 45℃)
- Earthquake load: Base shear coefficient = 0.18 (Zone 3 in earthquake zone map)

Concrete Design Strength

- Deck slab, RC girder: 30 Mpa
- Substructure: 30 Mpa
- Under water concrete: 24 Mpa
- Lean concrete: 18 Mpa

Steel Plates

- For main member and splice: JIS G 3106-SM490Y
- For diaphragm and stiffener: JIS G 3101-SM400
- Other minor members: JIS G 3101-SS400

Steel Materials

- Reinforcing steel bars: SD 40 (Min. yield point 390 N/mm2)
- High tensile bolt: JIS B 1186 F8T (Galvanized)
- Steel tubular pile: JIS A 525 STK400

Railing

- Galvanized steel pipe with RC posts
- Rail elevation is 1.0 m from sidewalk (or 0.75 m from curb where no sidewalk)

Bridge Freeboard

- Bridge over river without driftwoods：1.0 m

- Bridge over river with driftwoods：1.5m

Geometric Standards of Bridge Approach Road

- The geometric standard of the bridge approach road is shown on Table 2.2-2.

Table 2.2-2 Geometric Standard of Bridge Approach Road

	Flat Terrain	Hilly Terrain	Mountainous Terrain
Carriageway Width (m)	4.5	4.5	4.5
Shoulder Width (m)	1.5 x 2	1.5 x 2	1.0 x 2
Design Speed (km/hr)	30	20	-
Horizontal Min. Curb Radius (m)	30	20	15
Maximum Grade (%)	10	10 (12)	10 (12)
Vertical Min. Curb Radius (m)	250	100	100
Vertical Min. Curb Length (m)	25	20	20

Note: 1. Figure in ( ) can be used where unavoidable case due to topographical reason.
2. Super-elevation for curbs is not provided since the roads are gravel surfacing.
3. Widening for curbs is not provided since traffic volume is small and running speed is slow.

Typical Cross Section of Bridge Approach Road

The Project bridge approach road structure is the same as the previous phases. The typical cross section of the bridge approach roads is shown in Figure 2.2-1. Macadam pavement (5cm thick) is paved for steep sections (5 % or steeper) and sections adjacent to the abutments (about 20 m from the abutments).

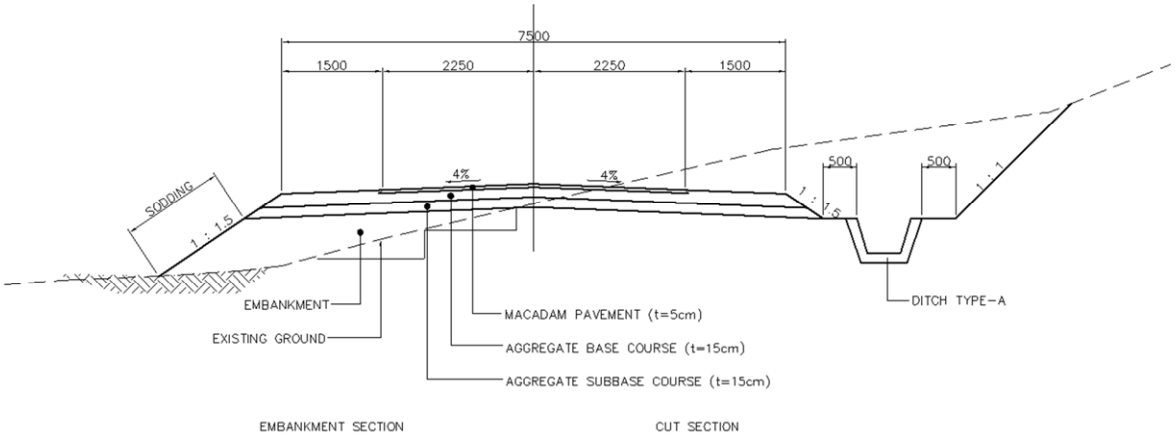


Figure 2.2-1 Typical Cross Section of Bridge Approach Road

2.2.1.3 Environmental and Social Consideration Policy

(1) Environmental Compliance Certificate

In the Basic Design Study, NTB Provincial Environmental Management Office (BLHP) has required to submit Environmental Management Plan (UKL) and Environmental Monitoring Plan (UPL) for the Project (Phase-2 and 3). The UKL and UPL were prepared by the Directorate General of Highways of the Ministry of Public Works and then submitted to BLHP on September 2008. BLHP evaluates the UKL and UPL and then issues the Recommendation for the implementation of the project. The recommendation declares the permission to undertake the works and requirement to comply with UKL and UPL. It was confirmed with BLHP that this UKL and UPL are effective for Phase-3 of the Project.

(2) Environmental Monitoring Plan

In accordance with the UKL and UPL and JICA Environmental and Social Consideration Guidelines, the environmental monitoring form which indicates the detailed monitoring items and monitoring methods was prepared as shown in Annex-6 of Appendix-4 Minutes of Discussions. The periodical monitoring will be undertaken by the site office of the Directorate General of Highways before and after the construction and every 6 month during the construction. The monitoring result will be reported to BLHP and JICA Indonesia Office.

(3) Land Acquisition

In the Basic Design Study, inquiry to the local government staff and the resident representatives was conducted and their consent for the proposed locations of bridges and approach roads and availability of the land acquisition for the construction was confirmed (Refer to Basic Design Report. The consent is effective for this project.) As a result, it is found that most of the bridge sites are located on government owned lands, so land acquisitions are not necessary. However, some bridge sites are owned by private and land acquisition is necessary. The list of land acquisition and land rent necessary for the Project is shown in Table 2.2-3. No resettlement/removal of house is necessary for the Project.

Table 2.2-3 Land Acquisition for the Project

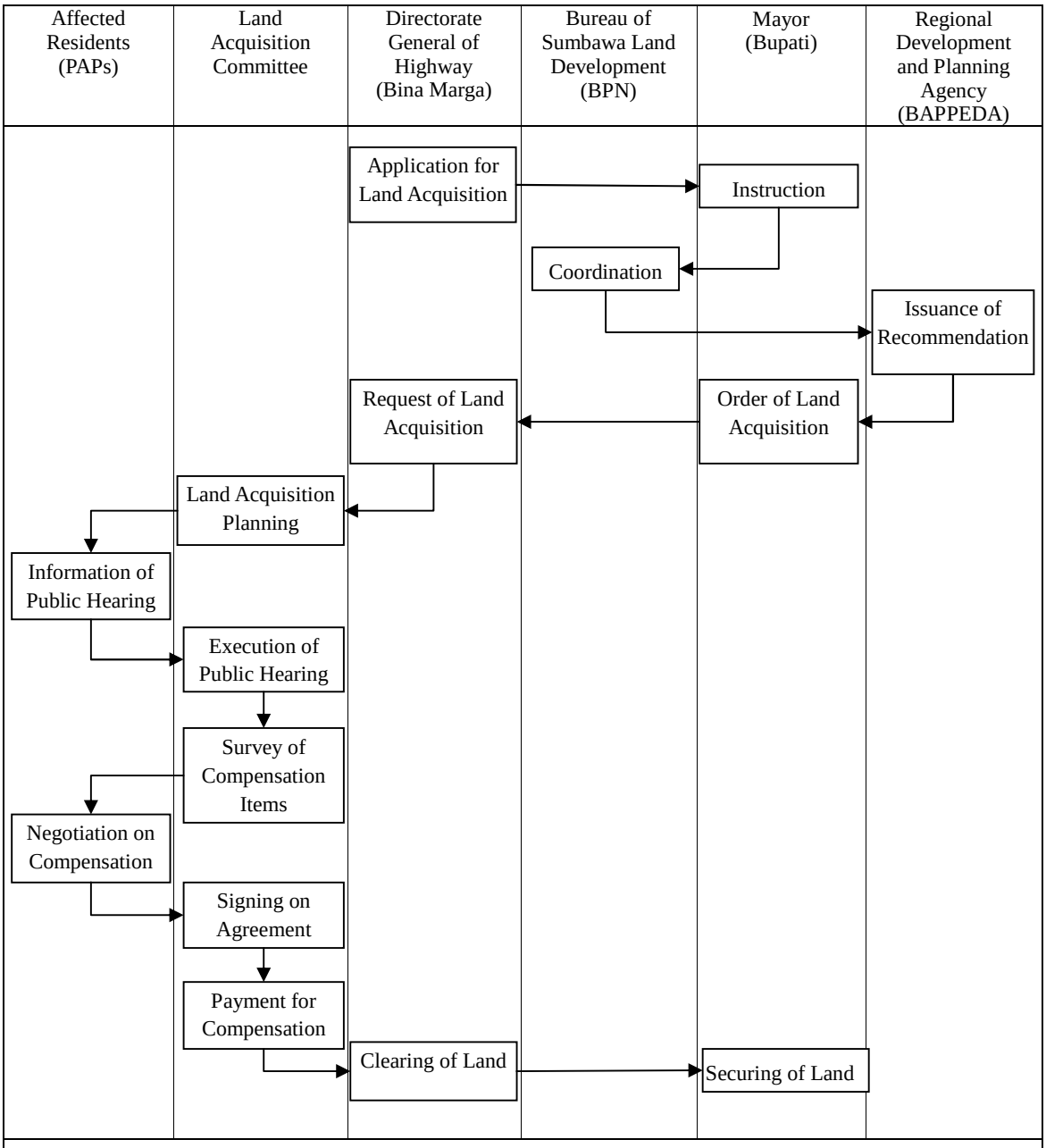
Bridge	Land Acquisition Area (sq. m)	Land Rent Area for Temporary Detour (sq. m)
BR-32 Petain III	1,080	0
BR-33 Molong	1,500	0
BR-34 Emang	300	350
BR-35 Kalbir	1,250	950

Land acquisition procedure

The basic laws for land acquisition and compensation has been constituted in the Presidential Regulation No.36/2005, and the procedure of land acquisition, public hearing, determination of compensation price, application of objection have been regulated. The road right-of-way (ROW) of the provincial road, which is 7.5m for each side from the center of the road, is regulated in Road Construction Law under the provincial law of Nusa Tenggara Barat No. 15 issued in 1995. However, if the ROW has not yet been clearly established anywhere, the government admits the ownership of the land within the ROW which have been resided for more than 20 years, and compensates for the cases of land acquisition for constructions. Therefore, illegally occupied land within the ROW for less than 20 years will never be compensated by the government but compensation is made only for houses, trees, wells and other properties when necessary to be removed for constructions.

The land acquisition for the Project should be started after the signing of the relevant Exchange of Note of the Project between the Japanese and Indonesian governments and should be completed before the time when its tender is placed. The tendering to procure a contractor will be started after the confirmation of the completion of the land acquisition. The land acquisition is responsibility of Sumbawa Regency Government. The procedure of the land acquisition is shown on Table 2.2-4. The land rent for temporary detour will be negotiated between the land owners and Sumbawa Regency Government and paid by the Regency.

Table 2.2-4 Procedure of Land Acquisition



Note: Land acquisition committee members are as follows:

-Deputy Mayor of Regency (Chairman)
-Chief of Regency Land Development Section
-National Land Development Regional Branch
-Public Works Sumbawa Branch, Nusa Tenggara Barat Provincial Government
-Regency Agricultural Section
-Regency Tax office
-Village Captains

2.2.2 Outline Design

2.2.2.1 Update of the Outline Design

(1) Countermeasure against River Condition Change

BR-13 Mone I Bridge

Installation of gabion mattress riverbank protection (2m x 2m x 20m) at both sides of the river at the upstream side of the bridge as shown in Figure 2.2-2 is planned as the countermeasure against future river meandering which might scour the abutments and approach roads.

BR-27 Lamar Bridge

Extension of cylindrical gabion riverbank protection to the upstream side (10 m extension) to widen the riverbank width as shown in Figure 2.2-3 is planned as the countermeasure against future riverbank erosion at the upstream.

(2) Review of Tubular Pile Length

Experience of Tubular Pile Driving in Phase-2

BR-8 Tatar Loka Bridge was designed with tubular pile foundation. The pile diameter is 800mm and the pile length is 14m for Abutment-1 and 18m for Abutment-2. The pile lengths were determined to obtain adequate bearing force composed of pile tip bearing force and pile skin friction force which were estimated using “Static Estimate Formula of Bearing Force of Open Tubular Piles” in Bridge Design Specifications of Japanese Road Association. The bearing stratum is very dense silty-sand of which N-value is more than 50. The pile penetration length into the bearing stratum was about 1.5m.

In the driving of the tubular piles, the estimated pile bearing forces obtained from measurement of penetration and rebound per driving of piles were insufficient to the required bearing forces. To settle this, the piles were extended from 4 to 11m (average 8.6m) from the design lengths to gain the sufficient bearing forces. The reason why the piles with design length did not gain the expected bearing forces is deemed that the tip of the open tubular piles were not closed with the bearing soils as commonly occurred but the tubular piles slipped into the bearing soil.

Revision of the Design Length of Tubular Piles

Among the bridges of Phase-3, 5 bridges were designed with tubular pile foundation. All of the piles are 800mm diameter. The similar happening might occur with the bridges where their bearing soil types are similar to Tatar Loka Bridge. As the

countermeasures against this problem, the following measures are proposed:

- In case the bearing soil type is similar to Tatar Loka Bridge (dense silty-sand), the design pile length is revised to penetrate into the bearing stratum with around 5m depth which is deemed adequate to completely close the pile tips with bearing soils. The review of the design pile length is shown in Table 2.2-5.

- In case the bearing soil type is grave, the pile length is revised to extend one or two meters longer because the tubular piles of Tatar Loka Bridge have easily penetrated the hard gravel stratum at shallow depth. The tubular pile length of BR-27 Lamar Bridge Abutment-2 was originally designed to rest on the hard gravel stratum at the shallow depth, however it is revised to penetrate the shallow gravel hard stratum and then rest on the deeper bearing stratum.

- In case above piles with revised lengths will not gain the required bearing force in the driving, the pile tip cross plate as shown in Figure 2.2-4 will be attached in order to secure the closure of the pile tip with bearing soils.

- In case the finally driven pile lengths will be different from the above revised design length, adjustment of payment will be made based on the agreed unit price of the piling work within the available budget (The amount mentioned in Exchange of Note agreed by the governments).

Table 2.2-5 Review of the Tubular Pile Length

Bridge	Substructure	Type of Bearing Soil	Pile Length in B/D (m)	Revised Pile Length (m)
BR-16 Telonag I	Abument-1	Silty-sand	13.0	17.0
	Pier-1	Silty-sand	18.0	22.0
	Abutment-2	Silty-sand	15.0	19.0
BR-19 Sepang	Abutment-1	Bed Rock	17.0	17.0
	Abutment-2	Silty-sand	26.0	28.0
BR-27 Lamar	Abutment-1	Gravel	8.0	10.0
	Abutment-2	Gravel	11.0	26.0
BR-34 Emang	Abument-1	Silty-sand	13.0	16.5
	Pier-1	Silty-sand	15.0	18.5
	Abutment-2	Sandy-silt	14.5	18.0
BR-35 Kalbir	Abutment-1	Silty-sand	13.0	16.0
	Abutment-2	Silty-sand	11.5	15.0

The revision of the tubular pile length is shown with red color in the drawings of the bridge general plans as shown in Figure 2.2-3 to 9.

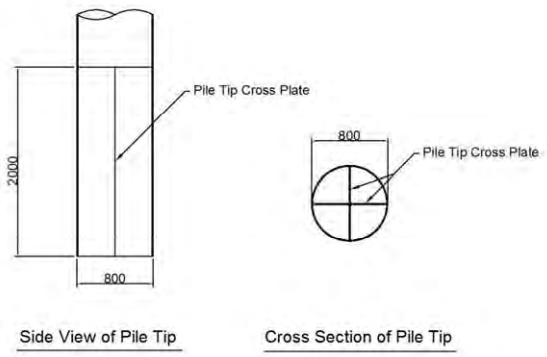


Figure 2.2-2 Pile Tip Cross Plate

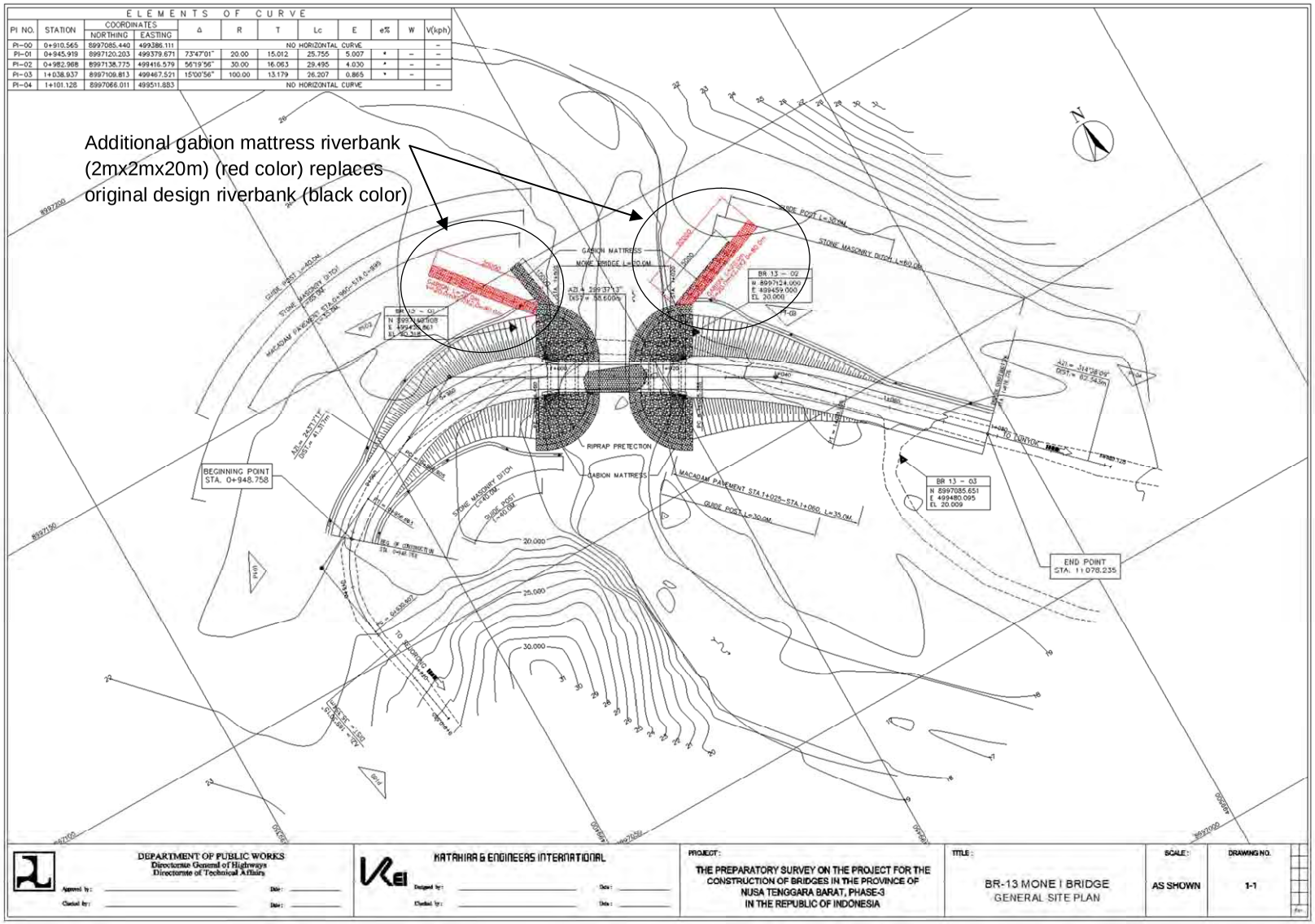


Figure 2.2-3 Additional Installation of Gabion Mattress Riverbank Protection for BR-13 Mone I Bridge

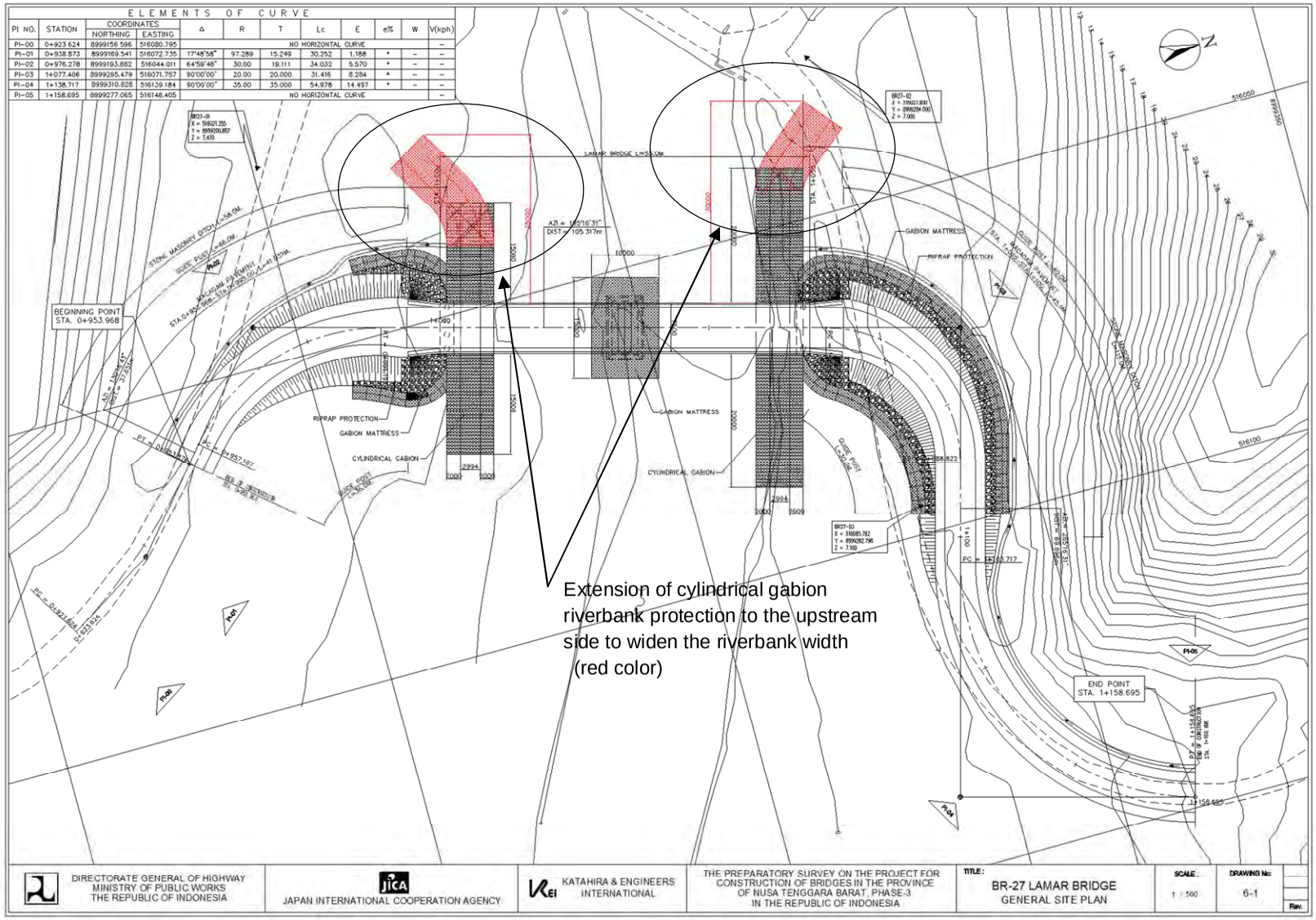


Figure 2.2-4 Extension of Cylindrical Gabion Riverbank Protection for BR-27 Lamar Bridge

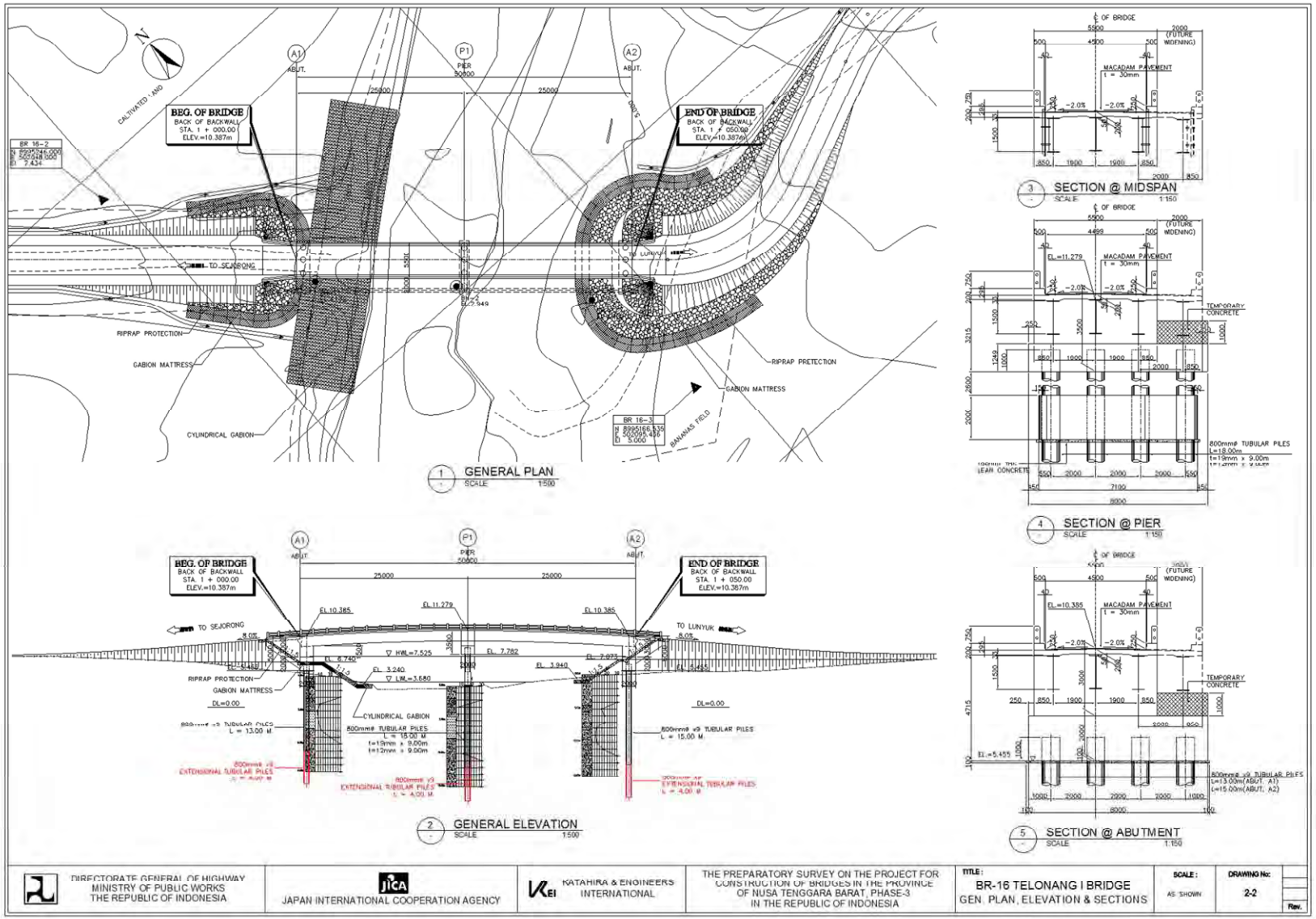


Figure 2.2-5 Revision of Tubular Pile Length of BR-16 Telonang I Bridge

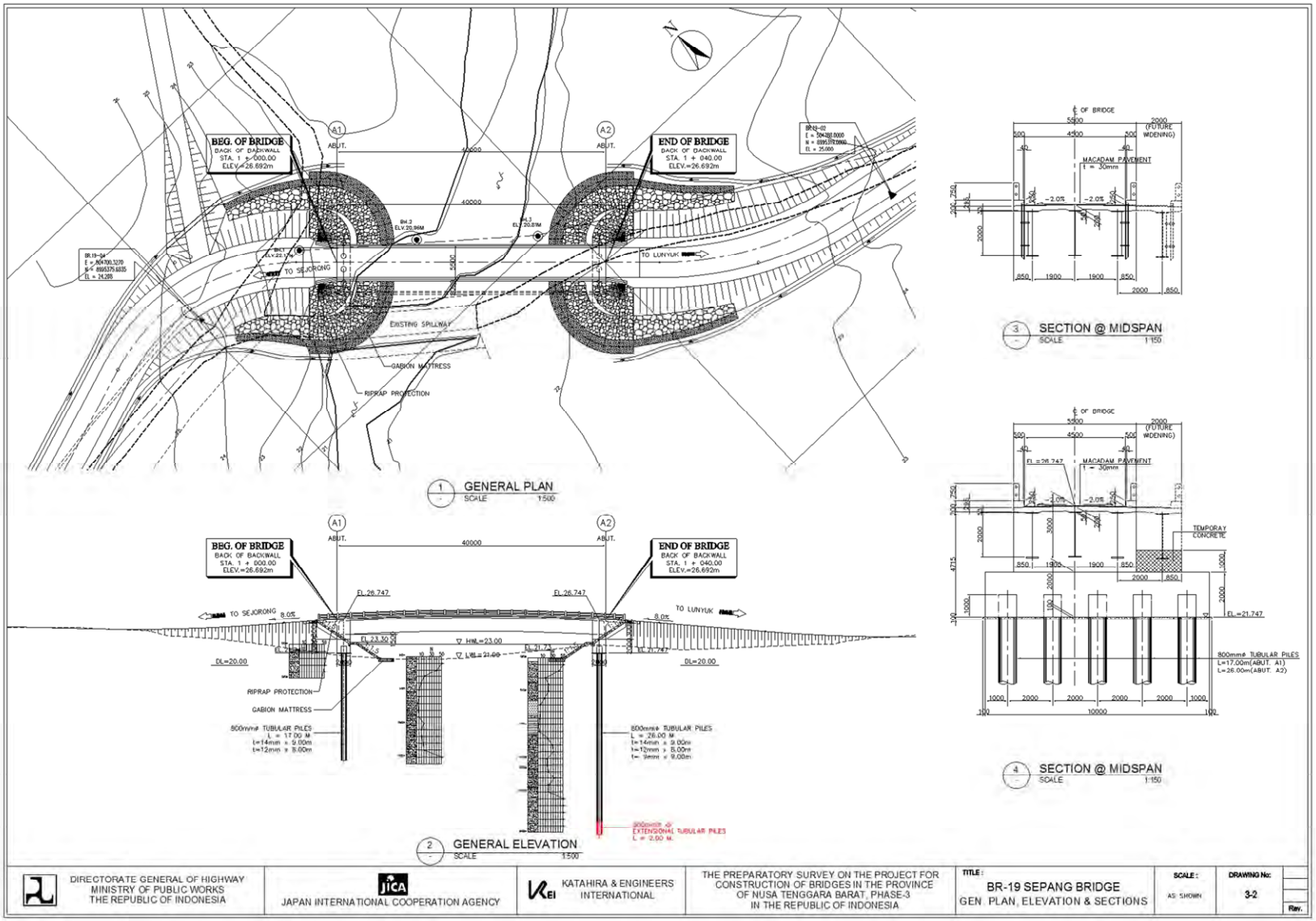


Figure 2.2-6 Revision of Tubular Pile Length of BR-19 Sepang Bridge

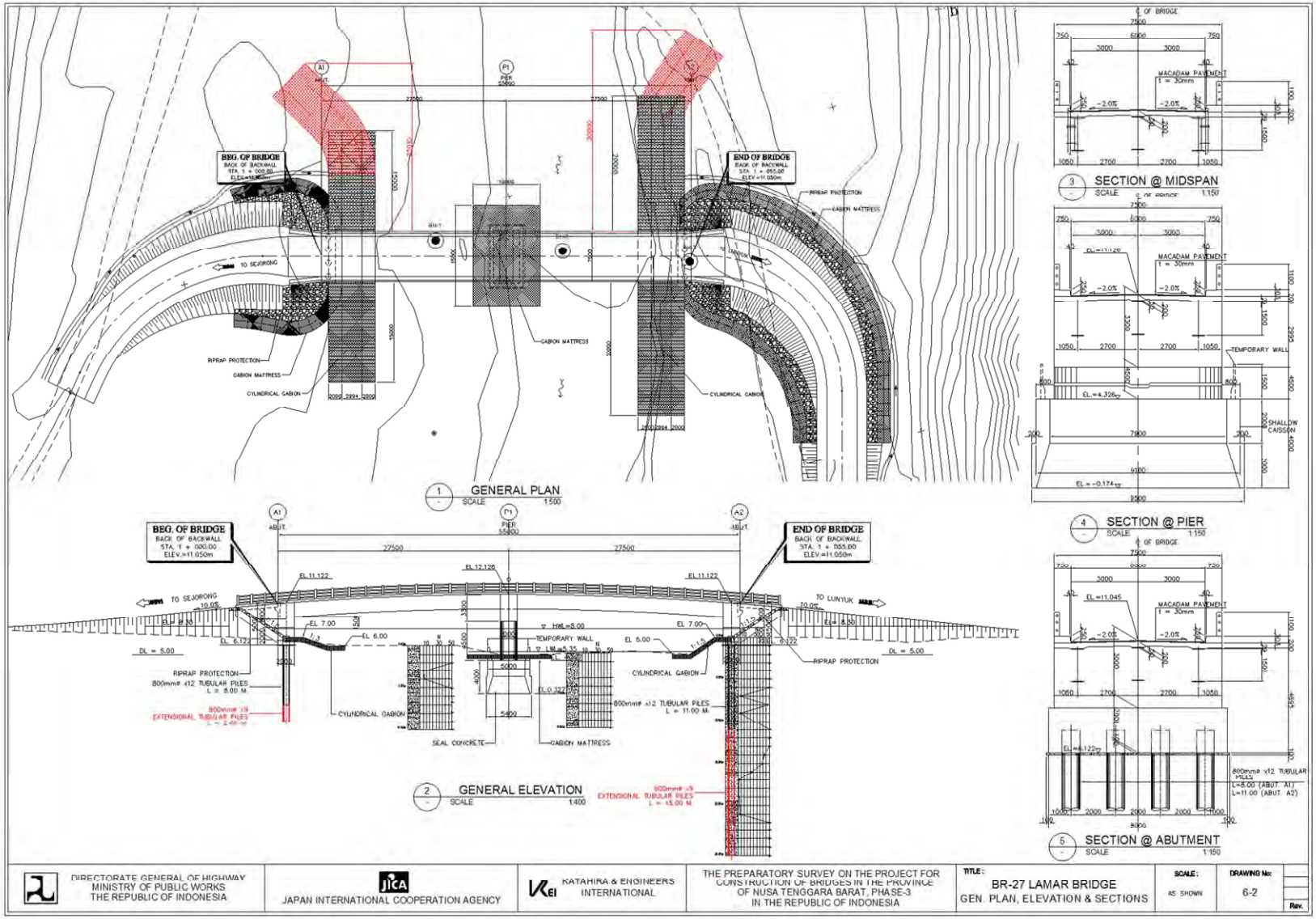


Figure 2.2-7 Revision of Tubular Pile Length of BR-27 Lamar Bridge

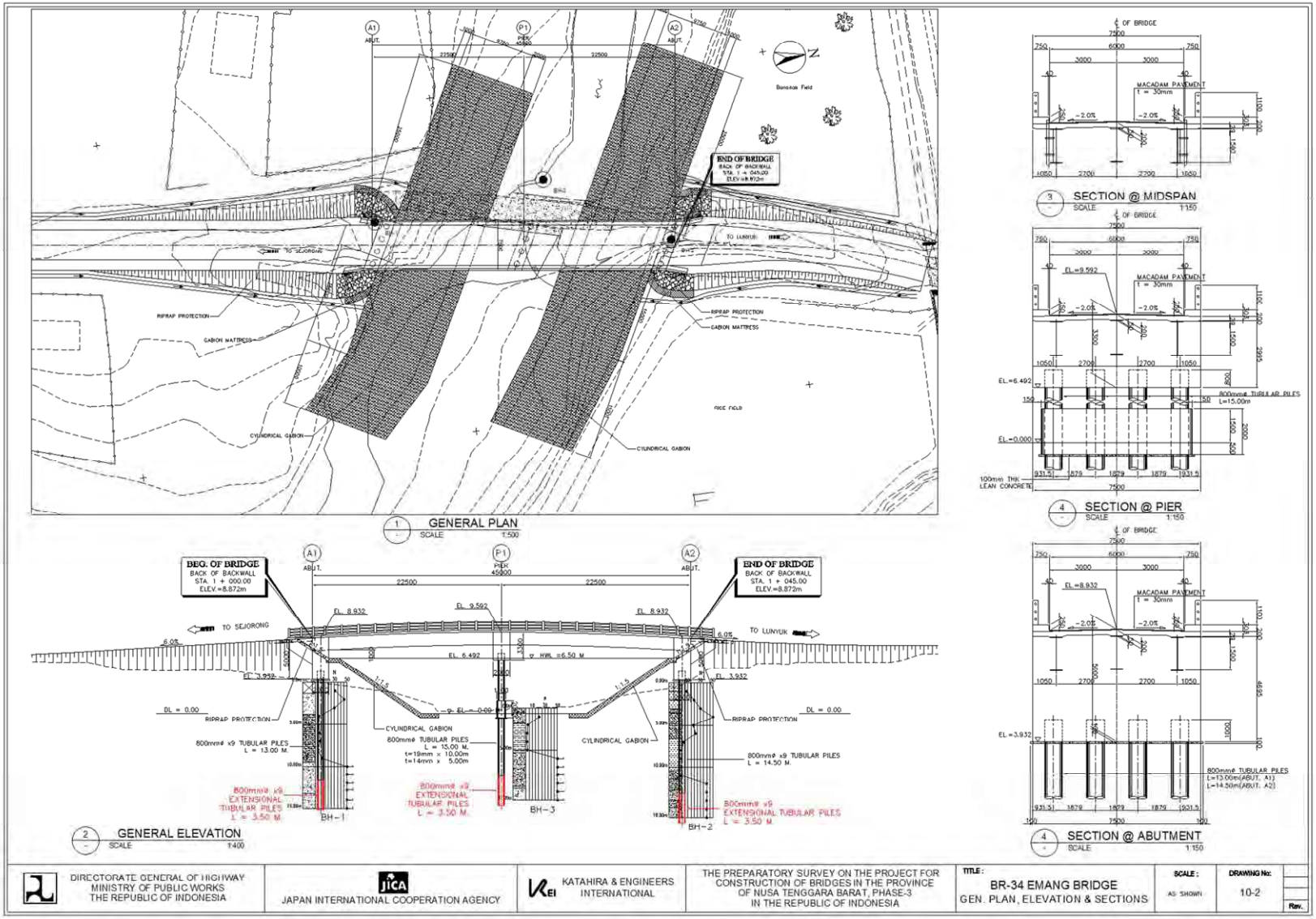


Figure 2.2-8 Revision of Tubular Pile Length of BR-34 Emang Bridge

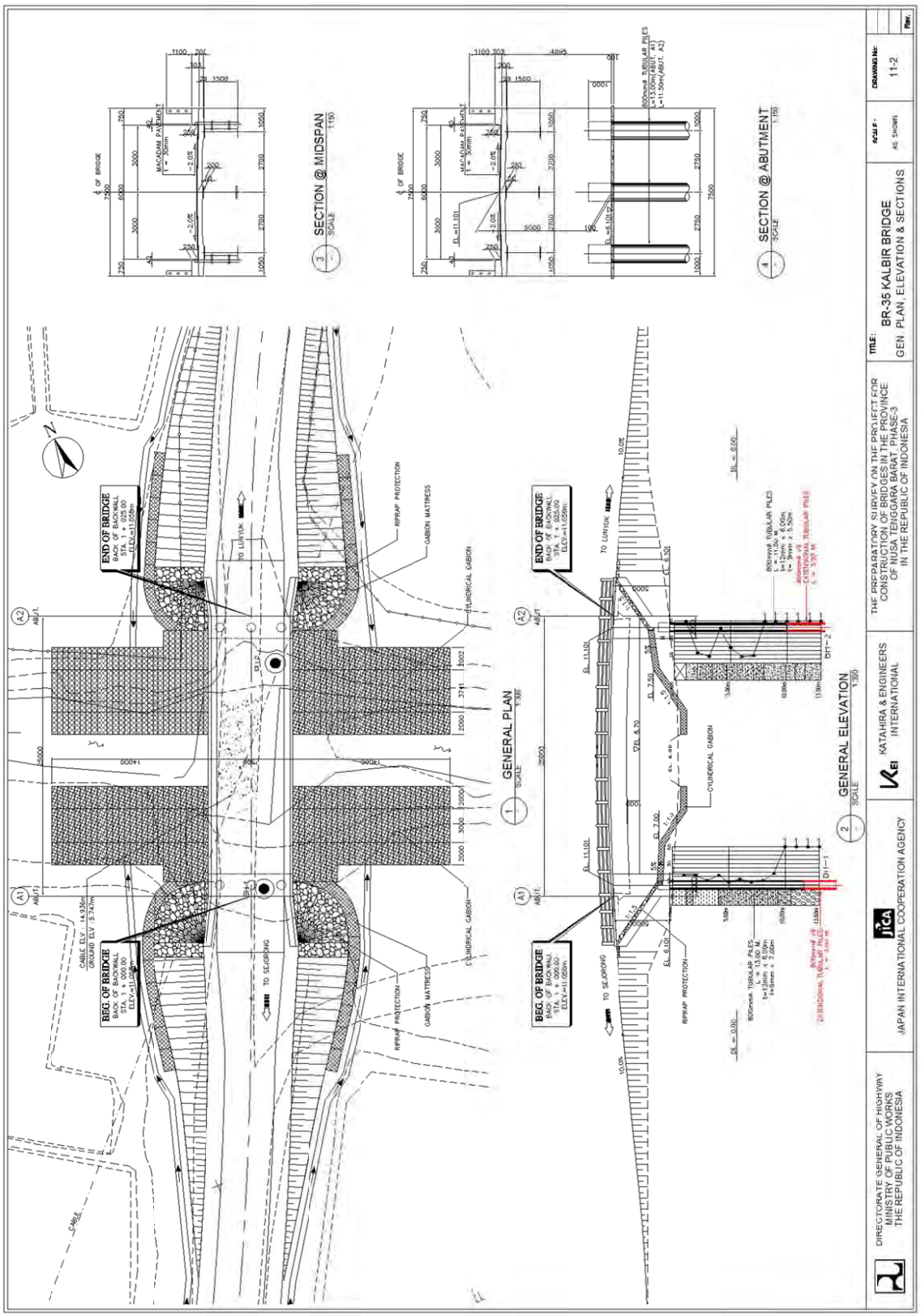


Figure 2.2-9 Revision of Tubular Pile Length of BR-35 Kalbir Bridge

2.2.2.2 Bridge Structures

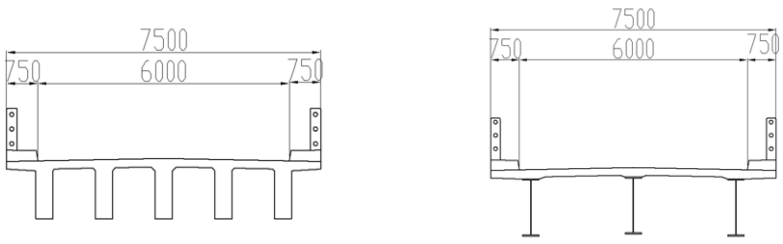
In Basic Design Study, the bridge structures were proposed with the following considerations:

Bridge Width

The bridge width of 6.0 m (carriageway width) is specified for bridges along provincial roads in Indonesia. However, as a special case, bridge in 4.5 m width was proposed for the Project bridges in the mountainous section (BR-13 to BR-22) since the traffic volume is very few and the driving speed is very slow. The bridge width components are shown in Figure 2.2-10.

In the future, when bridges in 4.5 m width become necessary to be widened to 6.0m, they will be widened by Indonesian side. However, the foundations (piles and footings) to be widened are constructed in this project beforehand since the widening of the foundation is difficult and costly.

4.5m wide Bridges for the Mountainous Section (BR-13～BR22: 5 bridges)



6m wide Bridges for the Flat Terrain Section (BR-27～BR35: 5 bridges)

Figure 2.2-10 Bridge Width Components

Superstructure Type

Reinforced concrete (RC) girder type was adopted for the bridges of which span is less than 20 m. RC girder bridges can be constructed with simple materials and equipment. Therefore, its construction is the easiest and most economical. However, it is not applicable where concrete supports cannot be installed in the river due to the reasons such as deep river, possibility of causing flood, and soft riverbed.

Plate girder type or Pre-stress concrete (PC) girder type are applicable for bridges with span longer than 20m. Plate girder is superior to PC girder in constructability though there is not much difference in cost and maintenance requirement between the two. Plate girder type was

adopted for all bridges with span longer than 20 m.

Foundation Type

Generally, at small river Project sites, there are hard strata of several meters beneath the riverbed; therefore, spread footing foundation type can be adopted. On the other hand, at relatively large river Project sites, hard strata are 5 to 15m deep from the riverbed; therefore, pile foundations are necessary. As a special feature of the Project site, the 2 to 3m thick surface of the layers deposited over soft strata tends to contain boulders. Tubular pile was adopted for all bridge pile foundations since it is the most superior in constructability and cost-effective. Precast pile is not applicable since the surface layers contain boulders and it requires large sized equipment.

Integral Structure Type

Integral structure type (superstructure and substructure is connected monolithically) was proposed for all bridges with the following reasons:

- Low cost: Bridges do not require any expansion joints, bearings and lessen the sizes of bridge members and number of piles.
- Minimal maintenance: Expansion joints and bearings which need frequent maintenance works are not necessary.
- Seismic resistant

2.2.3 Outline Design Drawings

The major components of the Project are shown on Table 2.2-6. The Outline Design Drawings are shown on the following pages.

Table 2.2-6 Major Components of the Project

No	Bridge No.	Bridge Name	Bridge Length (m)	Carriageway Width (m)	Superstructure Type	Foundation Type	Approach Road Length (m)
1	BR-13	Mone I	20.0	4.5	RC Girder	Spread Footing	109.5
2	BR-16	Telonang I	50.0	4.5	Plate Girder	Steel Tubular Pile	119.5
3	BR-19	Sepang	40.0	4.5	Plate Girder	Steel Tubular Pile	148.0
4	BR-20	Bontong	20.0	4.5	RC Girder	Spread Footing	130.0
5	BR-22	Blengkon	20.0	4.5	RC Girder	Spread Footing	120.0
6	BR-27	Lamar	55.0	6.0	Plate Girder	Steel Tubular Pile + Shallow Caisson	149.7
7	BR-32	Petain III	20.0	6.0	RC Girder	Spread Footing	108.9
8	BR-33	Molong	20.0	6.0	RC Girder	Spread Footing	140.0
9	BR-34	Emang	45.0	6.0	Plate Girder	Steel Tubular Pile	97.8
10	BR-35	Kalbir	25.0	6.0	Plate Girder	Steel Tubular Pile	97.3
Total			315.0	—	—	—	1220.7

REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF HIGHWAYS

THE PREPARATORY SURVEY ON THE PROJECT FOR THE CONSTRUCTION OF BRIDGES IN THE PROVINCE OF NUSA TENGGARA BARAT, PHASE-3 IN THE REPUBLIC OF INDONESIA

BASIC DRAWINGS

JAPAN INTERNATIONAL COOPERATION AGENCY

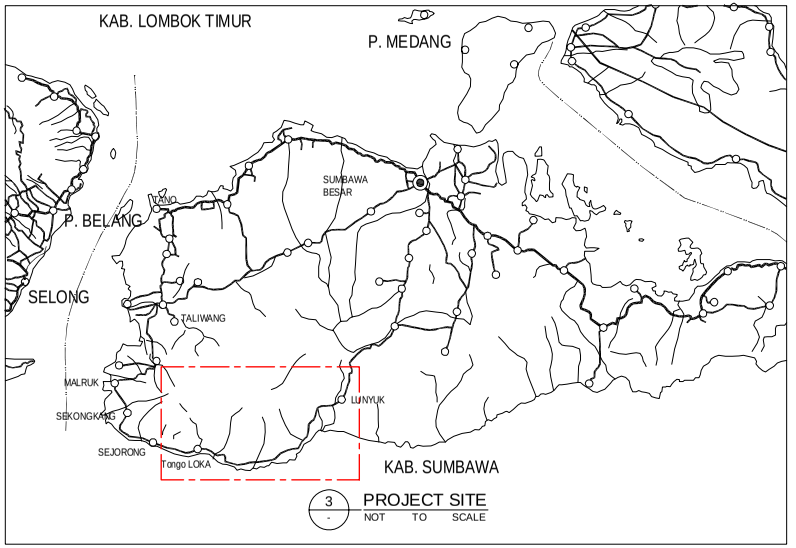
KATAHIRA & ENGINEERS INTERNATIONAL

GENERAL

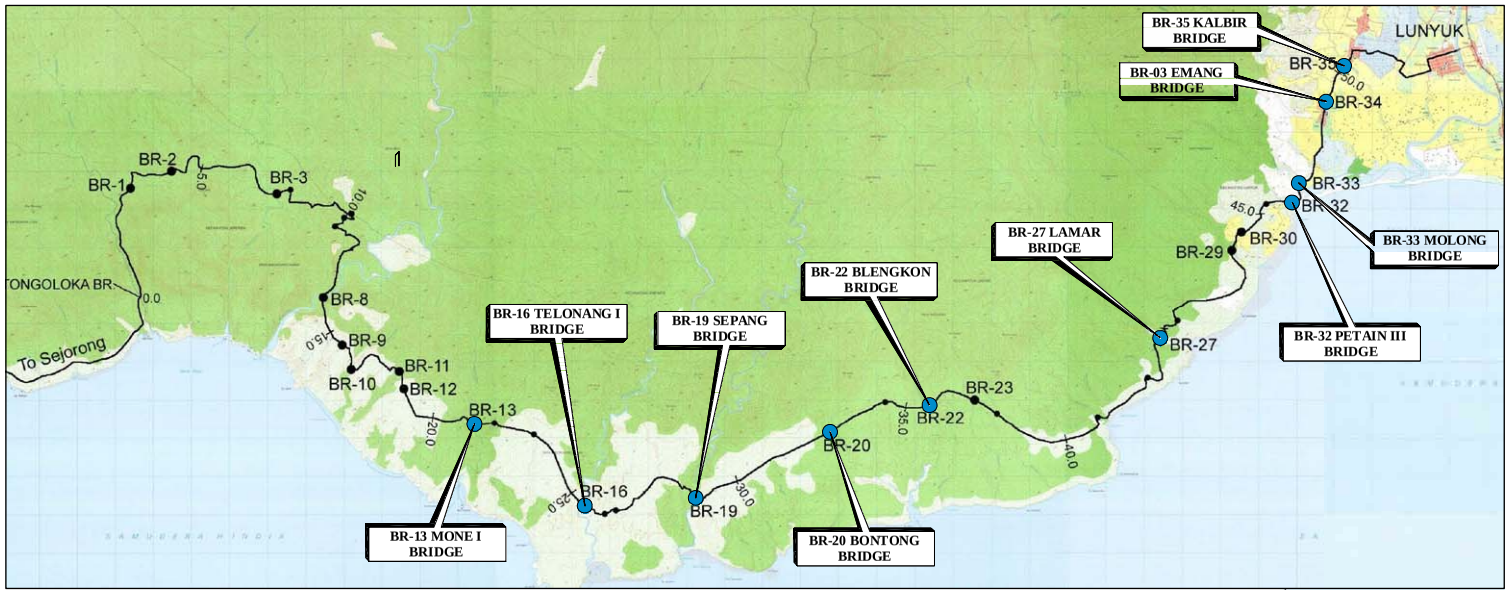
INDEX OF DRAWINGS

DIRECTORATE GENERAL OF HIGHWAY MINISTRY OF PUBLIC WORKS THE REPUBLIC OF INDONESIA	JAPAN INTERNATIONAL COOPERATION AGENCY	KATAHIRA & ENGINEERS INTERNATIONAL	THE PREPARATOY SURVEY ON THE PROJECT FOR CONSTRUCTION OF BRIDGES IN THE PROVINCE OF NUSA TENGGARA BARAT, PHASE-3 IN THE REPUBLIC OF INDONESIA	TITLE: INDEX OF DRAWINGS	SCALE: AS SHOWN	DRAWING No: 0-1 Rev.

2 - KEY MAP NOT TO SCALE



3 - PROJECT SITE NOT TO SCALE



1 - LOCATION MAP NOT TO SCALE

DIRECTORATE GENERAL OF HIGHWAY MINISTRY OF PUBLIC WORKS THE REPUBLIC OF INDONESIA	JAPAN INTERNATIONAL COOPERATION AGENCY	KATAHIRA & ENGINEERS INTERNATIONAL	THE PREPARATORY SURVEY ON THE PROJECT FOR CONSTRUCTION OF BRIDGES IN THE PROVINCE OF NUSA TENGGARA BARAT, PHASE-3 IN THE REPUBLIC OF INDONESIA	TITLE: LOCATION MAP AND KEY MAP	SCALE: AS SHOWN	DRAWING No: 0-2 Rev.

GENERAL NOTES FOR BRIDGES

A. DESIGN CRITERIA

1. CODES AND SPECIFICATIONS

THE DESIGN STANDARDS FOR THE STRUCTURES ARE :

- BRIDGE DESIGN MANUAL, BRIDGE MANAGEMENT SYSTEM (BMS6), BINA MARGA, 1992.
- STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO), 17TH EDITION 2002.
- SPECIFICATIONS FOR HIGHWAY BRIDGES, JAPAN ROAD ASSOCIATION (JRA), 2002

2. UNIT WT. OF MATERIALS

	UNIT WEIGHT
A. REINFORCED CONCRETE	25.00 kN/m^3
B. PLAIN CONCRETE	24.00 kN/m^3
C. ASPHALT WEARING COARSE	22.00 kN/m^3
D. STEEL	77.00 kN/m^3
E. COMPACTED SAND, EARTH OR GRAVEL	19.00 kN/m^3
F. SATURATED EARTH OR WATER	9.81 kN/m^3
G. OTHERS	AS INDICATED

B. MATERIALS

1. CONCRETE

a). UNLESS OTHERWISE INDICATED ON PLANS, THE CONCRETE CLASS / 28-DAY COMPRESSIVE STRENGTH SHALL BE AS FOLLOWS:

STRUCTURAL MEMBER	CLASS	28-DAY COMPRESSIVE STRENGTH MPa	MAX. AGG. SIZE	SLUMP
DECK SLAB, SIDEWALK, APPROACH SLAB, RC GIRDER	A	30	25	8-12
ABUTMENTS & PIERS	B	30	25	8-12
RAIL POST	C	30	15	8-12
CONCRETE BASE LEAN CONCRETE	D	18	25	8-12
SEAL CONCRETE	E	24	25	8-22

CONCRETE COVER OF REINFORCEMENT

MINIMUM CLEAR COVER FOR REINFORCEMENT		
STRUCTURE MEMBER	BR01, BR02, BR03, BR08, BR13 BR16, BR19, BR20, BR22, BR27, BR29, BR34, BR35	BR32 & BR33
SLAB, RC GIRDER	40 mm	40 mm
ABUTMENT & PIER COPING	75 mm	75 mm
FOOTING & WALL	75 mm	100 mm
RAILINGS AND SIDEWALK	40 mm	40 mm

2. STRUCTURAL STEEL, BOLTS AND WELDS

MATERIALS	REFERENCE SPECIFICATIONS
FOR MAIN MEMBER AND SPLICE	JIS G 3106-SM490Y
FOR DIAPHRAGM AND STIFFENER	JIS G 3101-SM400
OTHER MINOR MEMBERS	JIS G 3101-SS400

ALL STEEL MATERIALS SHALL BE GALVANIZED IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION OF THIS CONTRACT.

3. REINFORCING STEEL

a) ALL REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO SD 40, MINIMUM YIELD POINT 390 N/MM.

BAR SIZE	BAR AREA mm^2	WT. (Kg/m)
10mm	78.5	0.617
13mm	132.7	1.042
16mm	201.1	1.578
19mm	283.5	2.226
22mm	360.1	2.984
25mm	490.9	3.853
29mm	662.9	5.185
32mm	804.2	6.313

b) UNLESS OTHERWISE INDICATED IN THE PLANS, THE MINIMUM DEVELOPMENT LENGTH.

BAR SIZE	MIN DEVELOPMENT LENGTH		MIN LAP SPLICE	
	COMP.	TENSION	COMP.	TENSION
10mm	200mm	300mm	300mm	325mm
13mm	260mm	390mm	390mm	422mm
16mm	320mm	480mm	480mm	520mm
19mm	380mm	570mm	570mm	617mm
22mm	440mm	660mm	660mm	715mm
25mm	500mm	750mm	750mm	812mm
29mm	580mm	870mm	870mm	942mm
32mm	640mm	960mm	960mm	1040mm

C. CONSTRUCTION

ALL WORKS SHALL COMPLY WITH THE TECHNICAL SPECIFICATIONS OF THIS CONTRACT.

1. DIMENSIONS

1.1 SECTION, DIMENSIONS AND DISTANCES SHALL NOT BE SCALED FOR CONSTRUCTION PURPOSES. THE INDICATED DIMENSION SHALL GOVERN UNLESS OTHERWISE SPECIFIED.

1.2 ALL DIMENSIONS SHOWN ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

1.3 ALL STATIONING ARE IN KILOMETER PLUS METER AND ELEVATION IN METER.

2. REINFORCED CONCRETE

a. ALL EXPOSED EDGES SHALL BE CHAMFERED 25mm EXCEPT RAILINGS WHICH SHALL BE CHAMFERED AND FILLETED 13mm.

b. FOR CONCRETE DEPOSITED AGAINST THE GROUND, LEAN CONCRETE WITH A MINIMUM THICKNESS OF 50mm SHALL LAID FIRST BEFORE INSTALLING THE REINFORCEMENT. THIS LEAN CONCRETE SHALL NOT BE CONSIDERED IN MEASURING THE STRUCTURAL DEPTH OF CONCRETE SECTION.

c. BAR BENDING, SPLICING AND PLACING

(1) THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER/CONSULTANT FOR APPROVAL OF SHOP DRAWINGS INDICATING THE BENDING, CUTTING, SPLICING AND INSTALLATION OF ALL REINFORCING BARS.

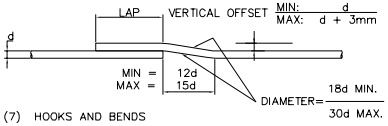
(2) BARS SHALL BE BEND COLD. BARS PARTIALLY EMBEDDED IN CONCRETE SHALL NOT BE FIELD BENT UNLESS PERMITTED BY THE ENGINEER/CONSULTANT.

(3) BAR SPLICING NOT INDICATED ON DRAWINGS SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER.

(4) NOT MORE THAN 50% OF THE BARS AT ANY ONE SECTION SHALL BE SPLICED.

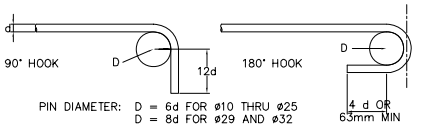
(5) UNLESS OTHERWISE SHOWN ON DRAWINGS, THE CLEAR DISTANCE BETWEEN PARALLEL BARS IN A LAYER SHALL NOT BE LESS THAN 1.5 TIMES THE NOMINAL DIAMETER OF THE BAR NOR LESS THAN 1.5 TIMES THE MAXIMUM SIZE OF COARSE AGGREGATE. THE CLEAR DISTANCE BETWEEN LAYERS SHALL NOT BE LESS THAN 25mm NOR ONE BAR DIAMETER. THE BARS IN THE UPPER LAYER SHALL BE PLACED DIRECTLY ABOVE THOSE IN THE BOTTOM LAYER.

(6) CRANKED SPLICES



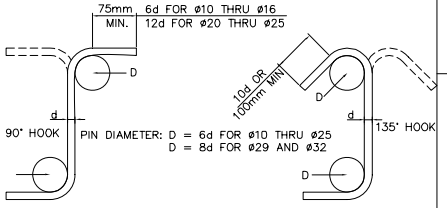
(7) HOOKS AND BENDS

DIMENSIONS OF 90-DEGREE AND 180-DEGREE HOOKS



PIN DIAMETER: D = 6d FOR ø10 THRU ø25
D = 8d FOR ø29 AND ø32

(8) DIMENSIONS FOR STIRRUPS AND TIE HOOKS



PIN DIAMETER: D = 6d FOR ø10 THRU ø25
D = 8d FOR ø29 AND ø32

d. CONSTRUCTION JOINT

(1) THE POSITION AND FORM OF ANY CONSTRUCTION JOINT SHALL BE AS SHOWN ON DRAWINGS OR AS AGREED WITH THE ENGINEER/CONSULTANT.

(2) THE INTERFACE BETWEEN THE FIRST AND SECOND POUR CONCRETES SHALL BE ROUGHENED WITH AN AMPLITUDE OF 6MM MINIMUM.

e. FALSEWORK

ALL FALSEWORK SHALL BE DESIGNED BY THE CONTRACTOR SUBJECT TO THE APPROVAL BY THE ENGINEER/CONSULTANT.

f. FORMWORK

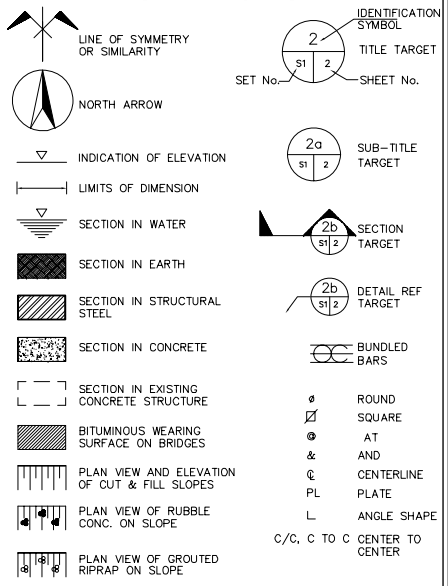
FORMWORKS SHALL BE CONSTRUCTED SUCH THAT IT WILL NOT YIELD UNDER THE LOAD AND SHALL BE SUCH AS TO AVOID THE FORMATION OF FINE. ALL CORNERS OF CONCRETE MEMBERS SHALL BE CHAMFERED TO 25mm UNLESS NOTED OTHERWISE ON DRAWINGS. STRIPPING OF FORMS AND SHORES SHALL BE AS DESIGNATED BY THE ENGINEER/CONSULTANT. THE FOLLOWING MAYBE USED AS A GUIDE.

	MIN. TIME
SHORING UNDER GIRDERS, BEAMS, FRAMES.	14 DAYS
DECK SLABS	14 DAYS
WALLS.	7 DAYS
COLUMNS.	7 DAYS
SIDES OF BEAMS AND ALL OTHER VERTICAL SURFACES	2 DAYS

g. PROTECTION AND CURING OF CONCRETE

CONCRETE SURFACES SHALL BE PROTECTED FROM HARMFULS EFFECTS OF SUN, WIND AND RUNNING WATERS AND SHALL BE KEPT DAMP FOR AT LEAST 7 DAYS.

SYMBOLS



ABBREVIATIONS

ABT	ABOUT	kPa	KILOPASCAL
ABUT	ABUTMENT	m	METER
BEG	BEGINNING	mm	MILLIMETER
BET	BETWEEN	MAX	MAXIMUM
BOTT	BOTTOM	MFWL	MAX. FLOOD WATER LEVEL
BR	BRIDGE	MIN	MINIMUM
BRG	BEARING	MO	MIDDLE ORDINATE
CLR	CLEAR	MPa	MEGAPASCAL
cm	CENTIMETER	N	NEWTON
COL	COLUMN	NF	NEAR FACE
CONC	CONCRETE	No.	NUMBER
CONST	CONSTRUCTION	O.C.	ON CENTER
CTR	CENTER	PEJ	PREMOULDED EXPANSION JOINT
DET	DETAIL	PVC	POLYVINYL CHLORIDE
DIAM	DIAMETER	PVI	POINT OF VERT. INTERSECTION
DIAPH	DIAPHRAGM	QTY	QUANTITY
DWG	DRAWING	R	RADIUS
EA	EACH	RC	REINFORCED CONCRETE
EF	EACH FACE	RDWY	ROADWAY
ELEV	ELEVATION	REINF	REINFORCEMENT
ENGR	ENGINEER	SDWK	SIDEWALK
EQ	EQUAL	SL	SLOPE
EW	EACHWAY	SP	SPIRAL
EXP	EXPANSION	SPCD	SPACED
EXT	EXTERIOR	SPCS	SPACES
EXIST	EXISTING	STD	STANDARD
FF	FAR FACE	STIR	STIRRUP
FTG	FOOTING	STA	STATION
GEN	GENERAL	STRUCT	STRUCTURE
HOR	HORIZONTAL	SYMM	SYMMETRY
HW	HIGH WATER	THK	THICK
INT	INTERIOR	TYP	TYPICAL
INTERM	INTERMEDIATE	VAR	VARIABLE
JT	JOINT	VERT	VERTICAL
L	LENGTH	VOL	VOLUME
LG	LONG	W	WIDTH
kg	KILOGRAM	W/	WITH
kN	KILONEWTON	&	AND

DIRECTORATE GENERAL OF HIGHWAY MINISTRY OF PUBLIC WORKS THE REPUBLIC OF INDONESIA	JAPAN INTERNATIONAL COOPERATION AGENCY	KATAHIRA & ENGINEERS INTERNATIONAL	THE PREPARATORY SURVEY ON THE PROJECT FOR CONSTRUCTION OF BRIDGES IN THE PROVINCE OF NUSA TENGGARA BARAT, PHASE-3 IN THE REPUBLIC OF INDONESIA	TITLE: GENERAL NOTES	SCALE: AS SHOWN / DRAWING No: 0-3 / Rev.