No.

MINISTRY OF SETTLEMENT AND REGIONAL INFRASTRUCTURE
THE REPUBLIC OF INDONESIA

BASIC DESIGN STUDY REPORT

ON

THE PROJECT

FOR

BRIDGE CONSTRUCTION

IN

THE CENTRAL AND NORTH SULAWESI PROVINCES

OCTOBER 2002

JAPAN INTERNATIONAL COOPERATION AGENCY
PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a basic design study on the Project for Bridge Construction in the Central and North Sulawesi Provinces and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team from February 17 to March 22, and from April 21 to July 5, 2002.

The team held discussions with the officials concerned 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, and as this result, the present was finalized.

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

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

October 2002

Takao Kawakami
President
Japan International Cooperation Agency

October 2002

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Bridge Construction in the Central and North Sulawesi Provinces in the Republic of Indonesia.

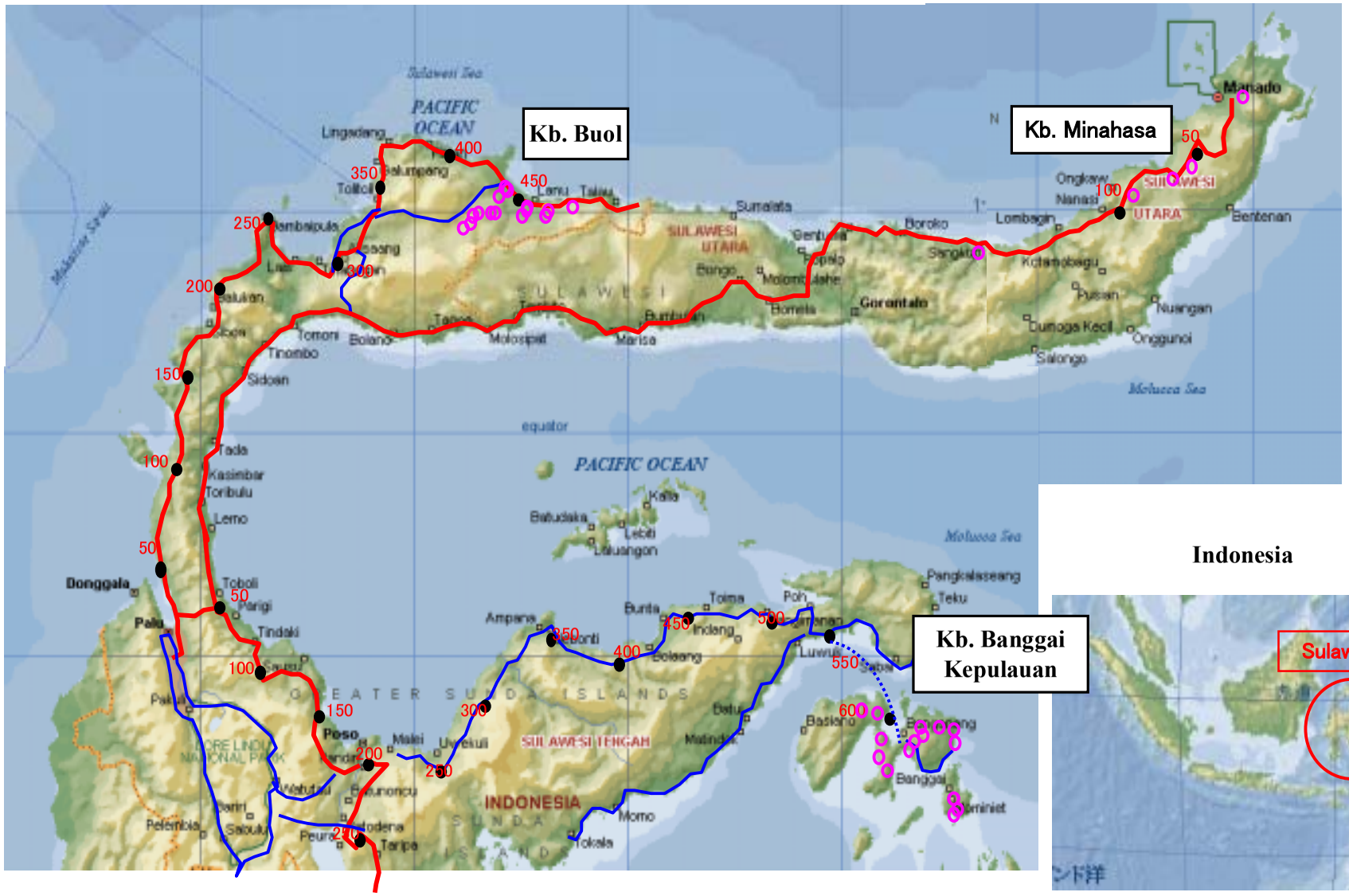
This study was conducted by Pacific Consultants International, under a contract to JICA, during the period January 2002 to October 2002. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Indonesia and formulated the 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,

NAGASE Kazuhiro
Project Manager,
Basic Design Study Team on
the Project for Bridge Construction in the
Central and North Sulawesi Provinces
Pacific Consultants International

Location Map of Candidate Bridges



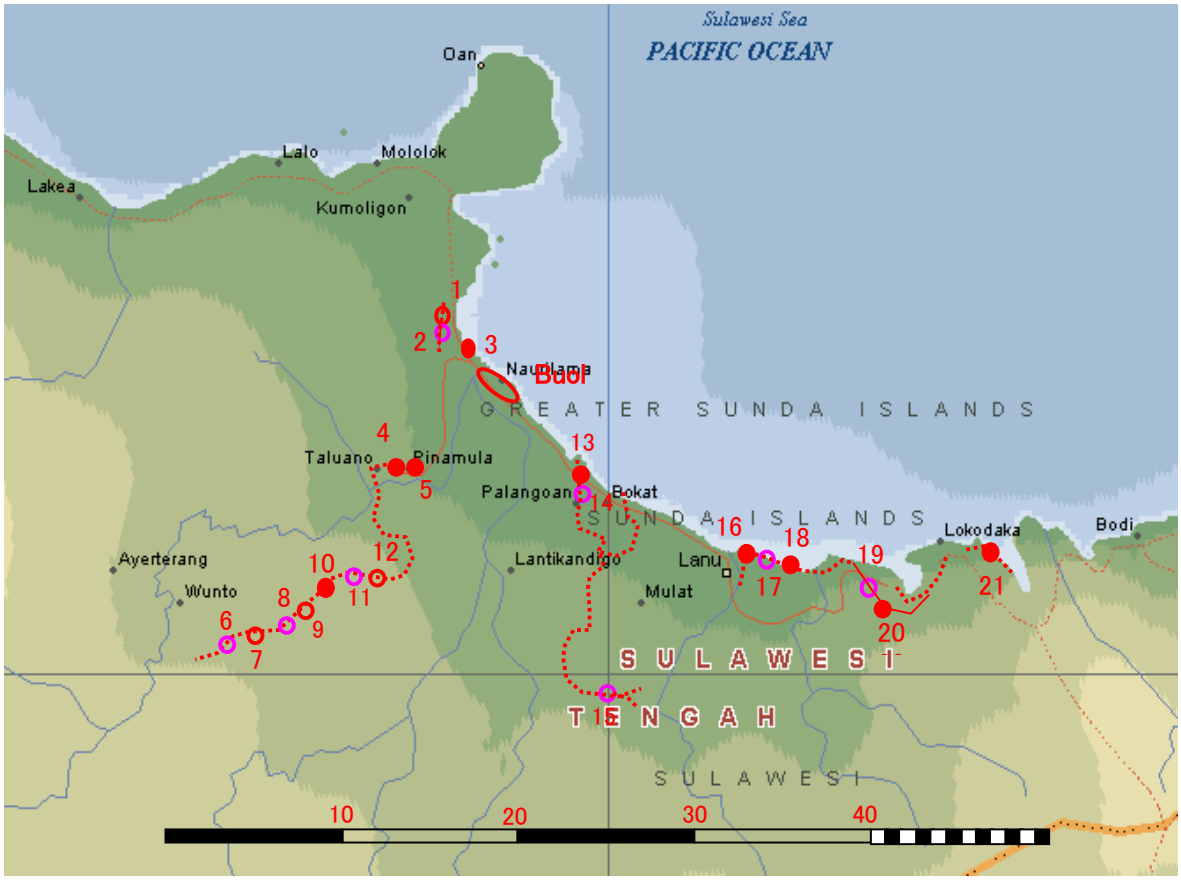
Indonesia

National Highway, 50km Post

Provincial Road, 50km Post

First Field Survey Bridges

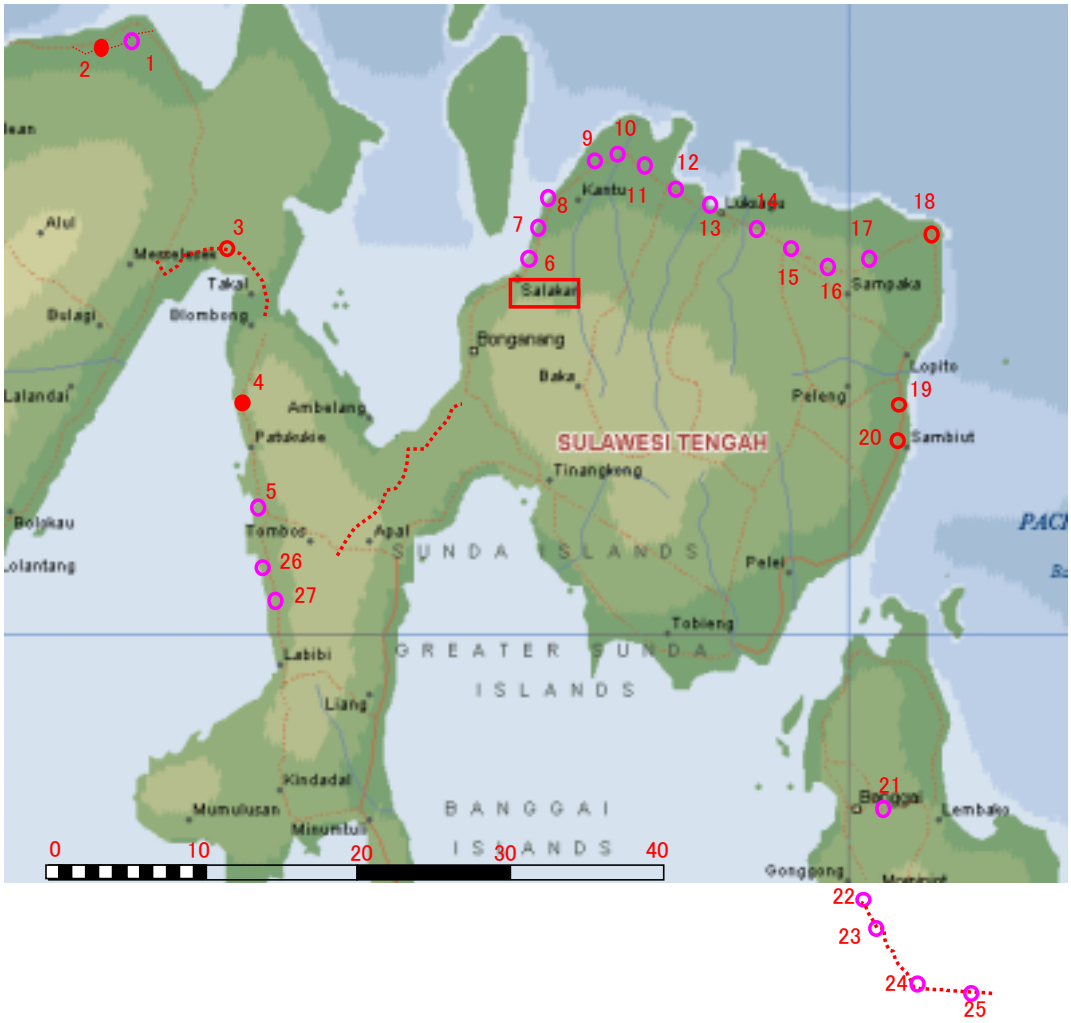
Location Map of Candidate Bridges in Buol Area



Candidate Bridges in Buol Area

No	Bridge Name	Link No.	Link Name	Length (m)	Remarks
1	BATUDOKA		Dalam Kota Koli	10.00	
2	BELAKANG PLN			10.00	
3	BUOL		Buol - Buyong	10.00	
4	PUJIMULYO Ⅰ		Pujimulyo - Pinamula	40.00	
5	PUJIMULYO Ⅱ			10.00	
6	KOKOBUKA Ⅰ		Kokobuka	45.00	
7	KOKOBUKA Ⅱ			20.00	
8	KOKOBUKA Ⅲ			20.00	
9	KOKOBUKA Ⅳ			10.00	
10	KOKOBUKA Ⅴ			20.00	
11	KOKOBUKA Ⅵ			10.00	
12	KOKOBUKA Ⅶ			10.00	
13	BUNGKUDU Ⅰ		Negeri Lama-Bokat	50.00	
14	BUNGKUDU Ⅱ			10.00	
15	MOPU		Bungkudu - Mopu	60.00	
16	TAYADUN Ⅰ		Tayadun - Poongan	10.00	
17	TAYADUN Ⅱ			20.00	
18	TAYADUN Ⅲ			30.00	
19	BONOBOGU Ⅰ		Dalam Kota Bonobogu	15.00	
20	KUALA BONOBOGU		Bonobogu - Inalatan	10.00	
21	MATINAN		Matinan - Taat	40.00	Original request
Total			21 bridges	460.00 m	

Location Map of Candidate Bridges in Banggai-Kepulauan Area



Candidate Bridges in Banggai-Kepukauan Area

No	Bridge Name	Link No.	Link Name	Length (m)	Remarks
1	KOYOBUNGA I	27	Patukuki - Seasa	10.00	
2	KOYOBUNGA II	27		10.00	
3	BALOMBONG	27		10.00	
4	KOLAK	27		10.00	
5	PATUKUKI	27		15.00	
6	LALONG	32	Salakan - Patam	10.00	
7	PAISU TALUP	32		10.00	
8	PONDING-PONDING I	32		10.00	
9	TATAKALAI I	32		10.00	
10	TATAKALAI II	32		10.00	
11	TATAKALAI III	32		40.00	Original request
12	LUKSAGU I	32		15.00	
13	LUKSAGU II	32		10.00	
14	LUKSAGU III	32		10.00	
15	PALAM	32		10.00	
16	PALAM I	33	Palam - Sambiut	10.00	
17	PALAM II	33		10.00	
18	PALAM IV	33		10.00	
19	KOMBUTOKAN I	33		10.00	
20	KOMBUTOKAN II	33		10.00	
21	BANGGAI	37	Banggai - Matanga	15.00	
22	ADEAN I	37	Banggai - Matanga	10.00	
23	ADEAN II	37		10.00	
24	BENTEAN	37		10.00	New request
25	TOLOKIBIT	37		10.00	
26	PATUKUKI I	38	Patukuki - Liang	40.00	
27	PATUKUKI II	38		10.00	
Total			27 bridges	345.00	

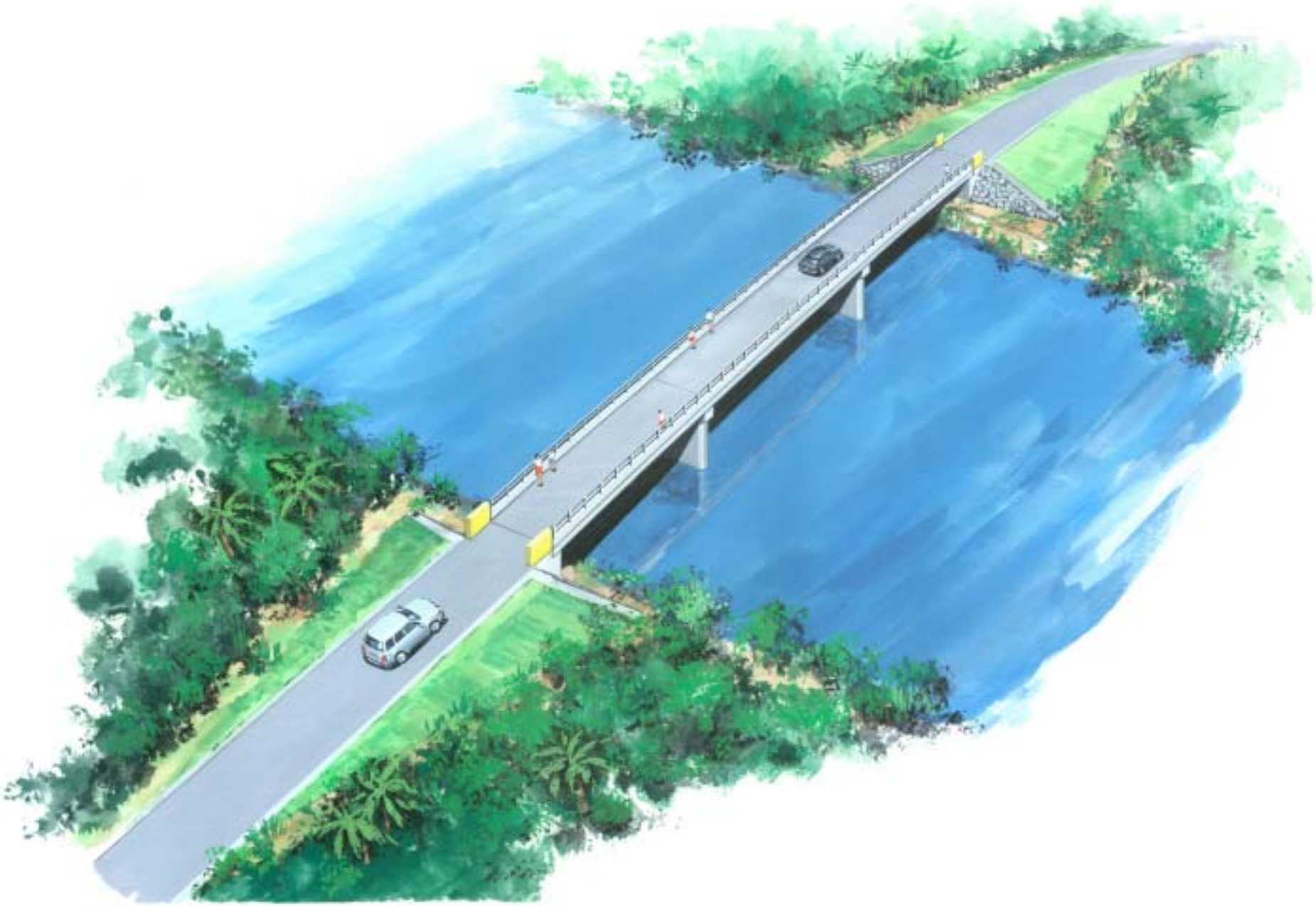
Note: Ambelang, Manggalai, Ponding II, Palm III, Peling Solit and Paisu Puso bridges are deleted due to constructed by Indonesian Side.

Location Map of Candidate Bridges in Manado/Minahasa/Kotamobagu Area

Candidate Bridges in Manado/Minahasa/Kotamobagu Area

No	Bridge Name	Link No.	Link Name	Length (m)	Remarks
1	RANOWANKO BRIDGE			55.00	
2	RANOYAPO BRIDGE			120.00	
3	POIGAR BRIDGE			123.00	Original request
4	MEGAWATI BRIDGE			110.00	
5	SANGKUP BRIDGE				New request
Total			5 bridges		

Perspective-1　Central Sulawesi Province ： Steel Girder Procurement Type



Perspective-2 Central Sulawesi Province : Bridge Construction Type
(Prestressed Concrete I-Girder : KOKOBUKA I Bridge)

Perspective-3　North Sulawesi Province : Bridge Construction Type
(Post-Tension　Hollow Slab : Megawati Bridge)

LIST OF FIGURES

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ABBREVIATIONS

%	:	per-cent
BAPPENAS	:	National development Planning Agency
BHN	:	Basic Human Needs
cm, CM	:	centimeter
D/D	:	Detailed Design
EIRTP	:	The Eastern Indonesia Region Transport Project
GDP	:	Gross Domestic Product
IMF	:	International Monetary Fund
JICA	:	Japan International Cooperation Agency
km, KM	:	kilometer
m, M	:	meter
mm, MM	:	millimeter
PC	:	Prestressed Concrete
PROPENAS	:	Program Pembangunan National/National Development Program
RC	:	Reinforced Concrete
Rp.	:	Indonesian Rupiah
US$	:	US Dollar

SUMMARY

Summary

Indonesia was severely affected by the economic crisis of the last decade but has, through long term planning of the market economy and along with the advancement of democracy; emphasis has been placed on the attainment of economic growth and the development of national lands.

However, this economic growth and development policy has led to regional imbalance within Indonesia. In particular, Sulawesi's development lags behind other regions such as Java and Sumatra and has not been enjoying the benefits of economic growth and development policy. Within Sulawesi, Central Sulawesi, which is located in the project area, is the least developed.

North Sulawesi also experienced significant scouring damage to bridges along national routes within its boundaries as a result of flooding induced by El Nino phenomena in December 2000. There are also otherwise deteriorating bridges along the national routes. These bridges are located along the Trans-Sulawesi Highway, which serves as a vital route supporting the industries and economy of not only North Sulawesi, but the entire island as well. However, due to the load limits (5 tons) placed on bridges with pier sinkage and/or excess deterioration, not to mention that the bridges are extremely dangerous for vehicular traffic, the Trans-Sulawesi Highway is not living up to its intended function.

In June 2001, the Government of Indonesia requested the Government of Japan for the replacement of eighty-two (82) bridges (in Central Sulawesi: Buol, twenty–one (21) bridges; Banggai Kepulauan, twenty-seven (27) bridges; Morowari, thirty-one (31) bridges. in North Sulawesi: Minahasa, three (3) bridges) in view of the undergoing PROPENAS for 1999-2004 (Five-Year National Development Plan); namely, “promotion of regional development” and “promotion of economic restructuring and strengthening of a sustainable and impartial developmental infrastructure based on the national economic system”.

The Government of Japan responded to the request for grant aid cooperation by directing the Japan International Cooperation Agency (JICA) to conduct a basic design study.

JICA thus sent the Basic Design Study Team to conduct on-site first field survey from February 17 to March 22, 2002 and the second field survey from April 21 to July 5, 2002. JICA then sent the Basic Design Study Team to Indonesia to explain Draft Final Report, to which the Indonesian authorities agreed to through the discussion and confirmation of the contents of the Report.

In the course of the meeting between the Study Team and Indonesian Government, in which explanation and discussion of the Inception Report took place and contents confirmed, in Central Sulawesi Province, the thirty-one (31) bridges in Kabupaten Morowari were removed from the project due to safety concerns. Also, in Kabupaten Banggai Kepulauan, six (6) bridges which were destroyed

in an earthquake occurring in May 2002 had already been replaced as a part of the post-quake reconstruction project; thus, these six were removed from the request and another six (6) added.

In North Sulawesi Province, two (2) bridges that are Megawati Bridge and Sungkap Bridge are added. El Nino had damaged the two (2) bridges and Megawati Bridge is deteriorating. Consequently, the number of the Study bridges was changed from eighty-two (82) to fifty-three (53) bridges.

Along with carrying out on-site survey of requested fifty-three (53) bridges, the Study Team surveyed and collected data relating to the executing organization and its level of competence, operational and maintenance ability, priority projects and relations to other donor countries, as well as the social importance of each bridge site within the sphere of the project

In selection of cooperation project bridges, the following basic evaluation criteria were set: 1) Soundness of existing bridge, 2) Importance of role in local road network, 3) Construct ability, 4) Social environment (possibilities of resettlement in case of new bridge construction), 5) Existence of plans for reconstruction through post-disaster projects by Indonesia, 6) Location along route necessary for high-priority bridge construction. Other considerations included making bridges under 15 meters in length the responsibility of the Indonesian government and removing bridges which are to be part of other donor projects. As a result, sixteen (16) bridges were selected for the cooperation project.

Among the sixteen (16) selected bridges, six (6) bridges were classified as "Steel Girder Procurement Type" and the remaining ten (10) for bridges as "Bridge Construction Type" based upon certain evaluating criteria.

(a) Criteria for Steel Girder Procurement Type:

Bridge construction, which can be carried out by the Indonesian side through procurement of steel girders, i.e.,

- Bridges length less than 20 meters
- Cases in which pier construction is unnecessary
- Cases not accompanied by construction requiring long-length steel pipe piles.

(b) Criteria for Bridge Construction Type:

- Bridges which are technically difficult for the Indonesian side to construct
- Cases in which land for bridge construction can be obtained
- Construction sites which are accessible
- Use of construction techniques which are more easily transferred

(Central Sulawesi Province: Pier construction with long steel pile foundation in the river, North Sulawesi Province: pier replacement of Poigar Bridge with temporally support of existing superstructure and Megawati Bridge construction in the urban area.)

Following classification, detailed bridge surveys, topological and geological surveys, hydrological surveys were conducted for the sixteen (16) bridges (six (6) steel girder procurement type and ten (10) bridge construction type), and basic design, construction plan and estimates were put together, as shown in Table 1.

Table 1 Contents of Project

Br. No.	Bridge Name	Bridge Length (m)	Superstructure	Abutments	Piers	Approach Road Length (m)	Component Type
B4	Pujimulyo I	25.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=20	N/A	123.8	B
B6	Kokobuka I	25.0+30.0+25.0=80.0	PC-I Girder	T- Type×2 Steel Pile (Friction Pile) φ40cm L=18m & L=15m N=20	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=20	143.0	B
B7	Kokobuka II	10.0	H-Beam	T-Type×2 Direct foundation (Additional soil investigation will be required by Indonesian side)	N/A	67.7	A
B8	Kokobuka III	20.0	H-Beam	T-Type×2 RC Pile (Bearing Pile)	N/A	87.7	A
B10	Kokobuka V	15.0	H-Beam	Gravity Type×2 Direct foundation	N/A	112.9	A
B11	Kokobuka VI	21.0	PC-I Girder	T- Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=12	N/A	154.1	B
B12	Kokobuka VII	30.0+30.0=60.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=20	T-Type×1 Steel Pile (Friction Pile) φ40cm L=20m N=20	474.0	B
B13	Bungkudu I	21.0+21.0=42.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=12	T-Type×1 Steel Pile (Friction Pile) φ40cm L=20m N=16	128.7	B
B17	Tayadun II	20.0	H-Beam	T-Type×2 RC Pile (Friction Pile)	N/A	158.0	A
B18	Tayadun III	20.0	H-Beam	T-Type×2 RC Pile (Friction Pile)	N/A	154.0	A
B19	Bonobogu I	20.0	H-Beam	T-Type×2 RC Pile (Friction Pile)	N/A	86.9	A
B21	Matinan	25.0+25.0=50.0	PC-I Girder	T- Type×2 Direct foundation & Steel Pile (Friction Pile) φ40cm L=20m N=20	T-Type×1 Direct Foundation	129.7	B
S26	Patukuki I	21.0+21.0=42.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=12	T-Type×1 Steel Pile (Friction Pile) φ40cm L=20m N=15	108.2	B
S27	Patukuki II		Box Culvert (6×4 m)			72.7	B
North Sulawesi							
3	Poigar	(120m)	Pier replacement and riprap work		T-Type×1 Direct foundation	87.3	B
4	Megawati	24.0+24.0+24.0+15.0 =87.0	PC-Hollow Slab	T- Type×2 Direct foundation & Bored Pile (Bearing Pile) φ100cm L=11m N=8	T- Type×3 Direct foundation & Bored Pile (Bearing Pile) φ100cm L=7m N=8	-	B

Note: Component Type A=Steel Girder Procurement Type, Component B=Bridge Construction Type

The project execution period for “Steel Girder Procurement Assistance” bridges is about 19 months, broken down into period of 10 months for detailed design and about 9 months for procurement. The project execution period for “Bridge Construction Assistance” is 33 months, broken down 10 months for detailed design and 23 months for construction.

The executing agency for this project is Ministry of Settlement and Regional Infrastructure, and implementation agency Directorate General of Regional Infrastructure. Central and South Sulawesi Provincial Governments will be in charge of the maintenance following the completion of the project, as their respective organizations' implementation and maintenance capabilities have been deemed sufficient administration of this project.

The following effects are expected from the implementation of the project:

(1) Direct Effects

1) Central Sulawesi

1. More consistent and safety transportation availability

Year-round transportation will be made available, daily life of local inhabitants will be improved (force to wade or use small boats to cross the rivers, transportation of agriculture products and fertilizer, alleviation of detour routs to schools and hospitals).

2. Increase of Traffic Load for Heavy Vehicle (5 ton to 20 ton)

Traffic load limit increase to 20 ton, heavy loaded road network within Kabupaten will be formed.

3. Deduction of Transportation Time

Rehabilitation of torn road network, for example, transportation time from Kokobuka area to Buol Port will be deducted 30 minutes from 2 hours 15 minutes to 1 hour 45 minutes (driving speed suppose to 20 km/h).

2) North Sulawesi

The 5-ton limit now in effect on the bridges in alleviated and restoring the intended function of the Trans-Sulawesi Highway.

(2) Indirect Effects

1. Agricultural activity

With smoother traffic made possible along the road network, agricultural products are more easily and quickly shipped and the use of fertilizers becomes more practical, therefore vitalizing the agricultural industry.

2. Improved standard of living

With improved access to marketplaces, the shipment of daily necessities is facilitated and standard of living is improved.

3. Regional effects

   The construction of bridges whose absence caused traffic stoppages will not only have a favourable direct effect on local residents, but will also have an immense ameliorating effect on the transportation infrastructure, thereby promoting the longer term effects of economic and industrial development in surrounding regions as well as the project region itself.

4. National effects

   This project supports the PROPENAS: 1999-2004

This project is highly beneficial the early realization of an effective road network, bringing economic benefits and contributing to the living standards of local inhabitants; therefore is deemed valid for implementation as a grant aid cooperation project.

Furthermore, it must be remembered that without the required maintenance, it will not remain functional in the long term unless the governments of Central and North Sulawesi take full responsibility to maintain the bridges and access roads. In either state, careful inspection must be made of bridges, approach roads and revetment following times of flooding and repairs made for the smallest damage at the beginning. Each state must set aside a budget for such expenses.

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CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background of Request

Indonesia was severely affected by the economic crisis of the last decade but has, through long term planning of the market economy and along with the advancement of democracy; emphasis has been placed on the attainment of economic growth and the development of national lands.

However, economic growth and development policies have brought about regional disparities within the country. As a case in point, the development of the island of Sulawesi is somewhat behind that of Java and Sumatra, and it would not be overstating matters to say that it has not been benefiting sufficiently from any recent economic growth.

The Indonesian government has requested the study of seventy-nine (72) bridges in Central Sulawesi (twenty-one (21) bridges in Buol, twenty-seven (27) bridges in Banggai Kepulauan and thirty-one (31) bridges in Morowali) as well as North Sulawesi (three (3) bridges in Minahasa); hence, a total of eighty-two (82) bridges.

The bridges in Central Sulawesi subject to the study are along Kabupaten Road, and are wooden structures built twenty (20) years ago or more. These include old and deteriorated bridges, collapsed bridges, bridges damaged in the year 2000 by flooding, and bridges damaged in an earthquake in May the same year (magnitude 6.5). These conditions have made the lives of local citizens less than ideal, inhibiting daily activities such as school commuting, hospital access, and the shipment of agricultural products and daily necessities. Indonesia has requested the replacement of these bridges as a means of ameliorating the lives of local residents.

The study bridges located within North Sulawesi are located along the Trans-Sulawesi Highway, which is a lifeline to the industries and economy of the entire Sulawesi Island. The study bridges involved were affected by flooding caused by El Nino phenomena in November and December 2000, particularly sinking and scouring the piers. Indonesia has requested the replacement of these bridges as a means of restoring the function of the Trans-Sulawesi Highway by making it safe for traffic, particularly that of heavier vehicles.

1-2 Confirmation and Alterations Regarding Contents of Request

As part of the First Field Survey, confirmation of the contents of the request was conducted following explanation and discussion of the Inception Report with the Indonesian Government

(Regional Office of Ministry of Settlement and Regional Infrastructure), the Province of Central Sulawesi and the Kabupaten Buol and Banggai Kepulauan, and Province of North Sulawesi.

(1) Central Sulawesi Province

1) The Basic Design Study Team (The Study Team) explained to the Indonesian side that the thirty-one (31) bridges of Kabupaten Morowali, which were included in the original request, were deleted for reasons of personal security. Indonesian side once again requested the inclusion of these bridges in the study. The Study Team explained that a decision regarding the inclusion in the project bridges is made by the Japanese government and thereby difficult to comply with the request.

2) The Study Team explained to the Indonesian side the existence of a system as part of the Japanese Grant Aid, which involves the steel girder procurement for bridge construction. However, the Indonesian side did not display any interest.

3) Indonesian side made the following proposals to amend the contents of the request during discussion of the Inception Report:

Of the twenty-seven (27) bridges originally included in the study bridges, six (6) bridges in Banggai Kepulauan (Ambelang Br., Manggalai Br., Ponding II Br., Palam III Br., Peling Solit Br. and Paisu Puso Br.) which were damaged by the earthquake occurring on 4 May, 2000 have already been replaced with permanent structures (bridges or box culverts), and 6 other bridges (Adean I Br., Adean II Br., Bentean Br., Tolokibit Br., Patukuki I Br. and Patukuki II Br.) were proposed in their place. All bridges are located along Kabupaten Road. Kabupaten Buol prefecture made no amendment proposals.

(2) North Sulawesi Province

The addition of two bridges along the national Road (Megawati Br. and Sangkup Br.) was proposed.

1-3 First Field Survey Bridges for the Project

The study bridges settled upon through amendment and confirmation of contents of request are shown in Table 1-1.

The study bridges total fifty-three (53), including forty-eight (48) in Central Sulawesi (twenty-one (21) in Buol, twenty-seven (27) in Banggai Kepulauan) and five (5) in North Sulawesi.

Table 1-1 List of Bridges Included in the First Field Study

Br. No.	Bridge Name	Location (Name of Desa)	Existing Bridge Conditions				
			Length (m)	Width (m)	Type of Bridge	Damage Level	
						Super Structure	Sub Structure
Central Sulawesi: Kabupaten Buol (Kab. Road)							
B1	Batudoka	Buol	8.0	2.3	Wooden	Impassable	Terrible
B2	Belakang PLN	Buol	14.3	2.0	Wooden	Good	Good
B3	Boul	Buol	8.0	3.0	Wooden	Impassable	Terrible
B4	Pujimulyo I	Pujimulyo	23.0	4.0	Wooden	Poor	Terrible
B5	Pujimulyo II	Pujimulyo	8.8	—	Wooden	Impassable	Terrible
B6	Kokobuka I	Kokobuka	80.0	2.0	Suspension	Impassable	Poor
B7	Kokobuka II	Kokobuka	No Bridge	—	—	No Bridge	No Bridge
B8	Kokobuka III	Kokobuka	15.0	3.0	Wooden	Impassable	Terrible
B9	Kokobuka IV	Kokobuka	10.0	5.0	Wooden	Good	Poor
B10	Kokobuka V	Kokobuka	No Bridge	—	—	No Bridge	No Bridge
B11	Kokobuka VI	Kokobuka	20.0	4.0	Wooden	Poor	Poor
B12	Kokobuka VII	Kokobuka	No Bridge	—	—	No Bridge	No Bridge
B13	Bunkudu I	Bangkudu	33.0	4.2	Wooden	Terrible	Poor
B14	Bunkudu II	Kodolagon	9.0	5.0	Wooden	Good	Good
B15	Mopu	Mopu	50.0	3.0	Truss	Good	Good
B16	Tayadun I	Tayadun	12.4	4.0	Wooden	Good	Poor
B17	Tayadun II	Tayadun	18.0	4.0	Wooden	Good	Good
B18	Tayadun III	Tayadun	No Bridge	—	—	No Bridge	No Bridge
B19	Bonobogu I	Bonobogu	No Bridge	—	—	No Bridge	No Bridge
B20	Kuala Bonobogu	Bonobogu	8.0	4.0	Wooden	Good	Good
B21	Matinan	Matinan	No Bridge	—	—	No Bridge	No Bridge
Central Sulawesi: Kabupaten Banggai Kepulauan (Kab. Road)							
S1	Kayabunga I	Kayabunga	5.0	3.6	Wooden	Good	Good
S2	Kayabunga II	Kayabunga	5.0	3.6	Wooden	Good	Good
S3	Balombong	Balombong	6.0	3.1	Wooden	Good	Good
S4	Kolak	Kolak	8.9	3.8	Wooden	Good	Good
S5	Patukuki	Patukuki	10.8	3.8	Wooden	Good	Good
S6	Lalong	Lalong	5.8	3.8	Wooden	Good	Good
S7	Paisu Talup	Ponding Ponding	4.5	4.0	Wooden	Good	Good
S8	Ponding Ponding I	Ponding Ponding	7.3	3.9	Wooden	Good	Good
S9	Tatakalai I	Tatakalai	2.5	3.5	Box Culvert	Good	Good
S10	Tatakalai II	Tatakalai	6.1	3.8	Wooden	Good	Good
S11	Tatakalai III	Tatakalai	36.3	4.7	Truss	Good	Good
S12	Luksagu I	Luksagu	11.3	3.7	Wooden	Good	Good
S13	Luksagu II	Luksagu	7.8	3.9	Wooden	Good	Good
S14	Luksagu III	Luksagu	4.7	4.0	Wooden	Good	Good
S15	Palam	Palam	No Bridge	—	—	No Bridge	No Bridge
S16	Palam I	Palam	9.2	3.5	Wooden	Good	Good
S17	Palam II	Palam	7.7	5.0	Wooden	Good	Good
S18	Palam IV	Kombutokan	4.0	4.0	Wooden	Good	Good
S19	Kombutokan I	Kombutokan	8.2	3.7	Wooden	Poor	Poor
S20	Kombutokan II	Kombutokan	8.9	4.1	Wooden	Poor	Poor
S21	Banggai	Lelang	12.0	3.5	Wooden	Poor	Good
S22	Adean I	Timbong Mominit	6.1	4.0	Wooden	Good	Good
S23	Adean II	Timbong Mominit	6.0	4.0	Wooden	Good	Good
S24	Bentean	Bentean	5.0	3.9	Wooden	Good	Good
S25	Tolokibit	Tolokibit	5.0	3.9	Wooden	Good	Good
S26	Patukuki I	Patukuki	42.4	3.5	Wooden	Poor	Poor
S27	Patukuki II	Patukuki	6.0	3.6	Wooden	Poor	Poor
North Sulawesi (National Highway)							
1	Ranowanko	Amurang	55.0	7.0	Truss	Impassable	Terrible
2	Ranoyapo	Amurang	120.0	7.0	Truss	Impassable	Terrible
3	Poigar	Poigar	120.0	10.0	Plate Girder	Poor	Terrible
4	Megawati	Manado	101.0	8.0	Plate Girder	Terrible	Terrible
5	Sungkup	Sungcup	125.0	6.0	Truss	Good	Poor

Note: Ranowanko Br. and Ranoyapo Br. are under construction.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Super-ordinate Objective and Project Objective

This project is to be carried out according to the request by the Government of Indonesia view of the following points presented in the ongoing PROPENAS for 1999-2004 (Five-Year National Development Plan); namely, "promotion of regional development" and "promotion of economic restructuring and strengthening of a sustainable and impartial developmental infrastructure based on the national economic system."

The project objectives for each respective state, under the super-ordinate objective, are as follows:

1) Central Sulawesi

The road network of Kabupaten Buol and Kabupaten Banggai Kepulauan in Central Sulawesi, which forms the backbone of regional development, is undeveloped. There exist many unpaved sections, as well as bridges which have collapsed, been washed away by flood, or are significantly deteriorating, all of which call for immediate attention. Provincial and Kabupaten governments have conducted gravel paving (all weather type road project) and bridge repair in places, but the outlook for most bridges in need of repair or replacement is unclear. Furthermore, restoration of bridges damaged in the earthquake of May 2000 in Kabupaten Banggai Kepulauan has been limited.

In both of the above-mentioned Kabupatens, collapsed, washed-out or deteriorated bridges have cut off the local road network in many places, making the shipment of agricultural products and fertilizers, school and hospital commuters, and provision of daily necessities impossible by motorcycles or larger vehicles.

Due to the poor conditions of bridges, the above-mentioned activities face severe restrictions, causing bottlenecks throughout the region's road network. Local inhabitants are forced to wade or use small boats to cross the rivers. Such a situation is detrimental to development of industries and poverty is not alleviated.

This project aims to create a sound road network through the development of vital bridges from the viewpoint of promoting regional development according to "promotion of regional development" of the five-year plan.

2) North Sulawesi

The requested five bridges located in North Sulawesi are situated along an important national route (the Trans-Sulawesi Highway), which supports the industries and economy of the entire island of Sulawesi. The El Nino-induced floods damaged the five bridges in May and June of 2000, causing sinkage of piers and excess scouring, therefore making the bridges unsafe for the crossing of vehicles. Megawati Bridge has also deteriorated significantly and a weight limitation has been placed (5 tons). Therefore, the Trans-Sulawesi Highway is not living up to its intended function. This project aims to restore the function of the Trans-Sulawesi Highway from the viewpoint of "promotion of regional development as well as promotion of economic restructuring and strengthening of a sustainable and impartial developmental infrastructure based on the national economic system" of the five-year plan.

(2) Outline of the Project

1) Central Sulawesi

In order to fulfill the above-mentioned objectives, this project aims to carry out all weather type road project in Kabupaten Buol and disaster rehabilitation works by earthquake in Kabupaten Banggai Kepulauan while constructing bridges within these, in hopes of improving the road network within these Kabupatens. The project cooperation entails the construction of eight (8) bridges and the procurement of construction materials (steel girders) for six (6) bridges.

2) North Sulawesi

In order to fulfill the above-mentioned objectives, this project aims to carry out disaster rehabilitation work by El Nino in North Sulawesi Province by constructing Megawati Bridge and reconstructing the pier for Poigar Bridge, in hopes of improving the road network within North Sulawesi. Through this, it is believed that the Trans-Sulawesi Highway will recover its function as a main traffic artery. Project cooperation involves the construction of 2 bridges.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policies

(1) Basic Policy

The purpose of this grant aid project is to supply funds for the construction of sixteen (16) bridges, selected based on their evaluated level of importance out of the fifty-three (53)

requested for restoration, in order to contribute to the Indonesian government's development plan which aims to raise the living standards of the project region and advance industries therein, by ensuring a safe and smooth traffic system for Central Sulawesi (in particular Buol and Banggai Kepulauan Kabupatens) and North Sulawesi (in particular Trans-Sulawesi Highway).

The bridges selected for the process for chosen according to the following selection process:

1) Central Sulawesi

The lengths of requested bridges in this state ranged from 2.5 to 80 meters. The criteria for selecting from the candidate bridges were considered as described below.

i) Selection of project bridges

As a result of a two-stage selection evaluation process, fourteen (14) bridges (construction-type eight (8) bridges, procurement-type six (6) bridges) were selected from among seventy-nine (79) originally requested. Evaluation items of the first stage are as follows:

1. Thirty-one (31) bridges in Kabupaten Morowari were removed due to being in an unsafe area.
2. Bridge soundness (level of urgency)
3. Importance of role in regional road network
   - Importance of bridge (availability of detour route, detour distance)
   - Population of inhabitants benefited
4. Construction ability (difficulty, material transport, availability of construction yard)
5. Social Environment (possibility of resettlement issues caused by new construction)

Evaluation items of the second stage are as follows:

1. Bridges lese than 15 meters in length are put under the charge of the Indonesian government and removed as candidates.
2. Bridges, which are needed for transporting of construction materials to other bridge construction sites, will be included.
3. Bridges, which are to be the object of other donors, are removed as candidates.

ii) Determination of bridge length

Bridge length was determined in consideration of river criteria (cross section, design high water level, free board clearance).

1. Determination of abutment location

The rivers in the project area are natural rivers without dikes. As the river edges are frequently eroded, a hypothetical collapse line was considered.

2. Determination of bridge length and span alignment

The project bridges range in 10 to 80 meters in length. Due to the fact that pre-stressed concrete superstructure I-girder type is most commonly applied in Indonesia, as well as economic considerations, this will be the basic style with standard span lengths of 20 to 30 meters.

iii) Selection of Assistance Type

In this Project there are two components, namely Component A (Steel Girder Procurement Type) and Component B (Bridge Construction Type).

For the project bridges in Central Sulawesi, bridges that are deemed to be within the construction capabilities of local contractors are selected as procurement-type bridges, according to the following criteria:

1. Selection by bridge length

Due to limitations in construction machinery maintained by contractors in Central Sulawesi as well as actual construction experience, 20 meters is considered the upper limit of their construction capabilities. Therefore, bridges less than 20 meters in length will fall under the procurement-type (steel girders) category.

2. Selection by span alignment

Due to the fact that water depth at construction of piers within river is up to 4 meters, construction of highly waterproof steel sheet pile cofferdam for concrete pouring is required. Contractors residing in Central Sulawesi have no construction experience as such. Thus, bridges that require multiple spans fall under the construction-type category.

3. Selection by foundation type

On-site welding technology for long steel pipe piles is unavailable, furthermore, quality management can only be carried out by appearances; thus, foundation work which includes long steel pipe piles will fall into "construction-type" category, while

bridges for which direct foundation or concrete piles are options will fall into Steel Girder Procurement Type category.

A flow chart for the above selection processes is seen in Figure 2-1 and results of selection process are shown in Table 2-1.

As Table 2-1 indicates, six (6) bridges fall into the procurement-type category, and eight (8) bridges fall into the construction-type category.

Table 2-1 Results of Selection Process for Candidate Bridges in Central Sulawesi

Order	Br. No.	Bridge Name	Evaluation Point (Out of 100)	Planed Bridge Length (m)	Assistance Component	Remarks
1	B6	Kokobuka I	95	25 + 30 + 25 = 80	Construction Type	
2	B12	Kokobuka VII	90	30 + 30 = 60	Construction Type	
3	B19	Bonobogu I	85	20	Procurement Type	
3	B21	Matinan	85	25 + 25 = 50	Construction Type	
5	B10	Kokobuka V	81	15	Procurement Type	
6	B8	Kokobuka III	78	20	Procurement Type	
7	B7	Kokobuka II	74	10	Procurement Type	A part of Kokobuka Area Road Network.
8	B18	Tayadun III	68	20	Procurement Type	
9	B11	Kokobuka VI	63	21	Construction Type	
10	S26	Patukuki I	61	21 + 21 = 42	Construction Type	
11	B13	Bunkudo I	58	21 + 21 = 42	Construction Type	
12	S27	Patukuki II	56	Box Culvert (6.0×4.0m)	Construction Type	A part of Salakan Area Road Network.
13	B4	Pujimulyo I	54	25	Construction Type	
14	B17	Tayadun II	—	20	Procurement Type	A part of Kab. Buol Road Network

2) North Sulawesi

The project bridges were selected based on the following criteria i) emergency (soundness of bridge conditions), ii) disaster rehabilitation works by Indonesian side.

Indonesian side carried out temporally disaster rehabilitation works for Poigar Bridge, however there is a danger for traffic safety movement. Megawati Bridge has also deteriorated significantly and a weight limitation has been placed (5 tons). Therefore, Megawati and Poigar Bridge was selected for the bridge construction type due to the Trans-Sulawesi Highway is not living up to its intended function.

On the other hand, Ranowanko and Ranoyapo Bridge are constructing new bridges as a disaster rehabilitation works by Indonesian side. Therefore, Ranowanko and Ranoyapo Bridge were deleted from the Project. Sang Sungkup Bridge was deleted due to request rehabilitation of revetment only and low emergency and Indonesian side can carry out Sungkup Bridge rehabilitation works.

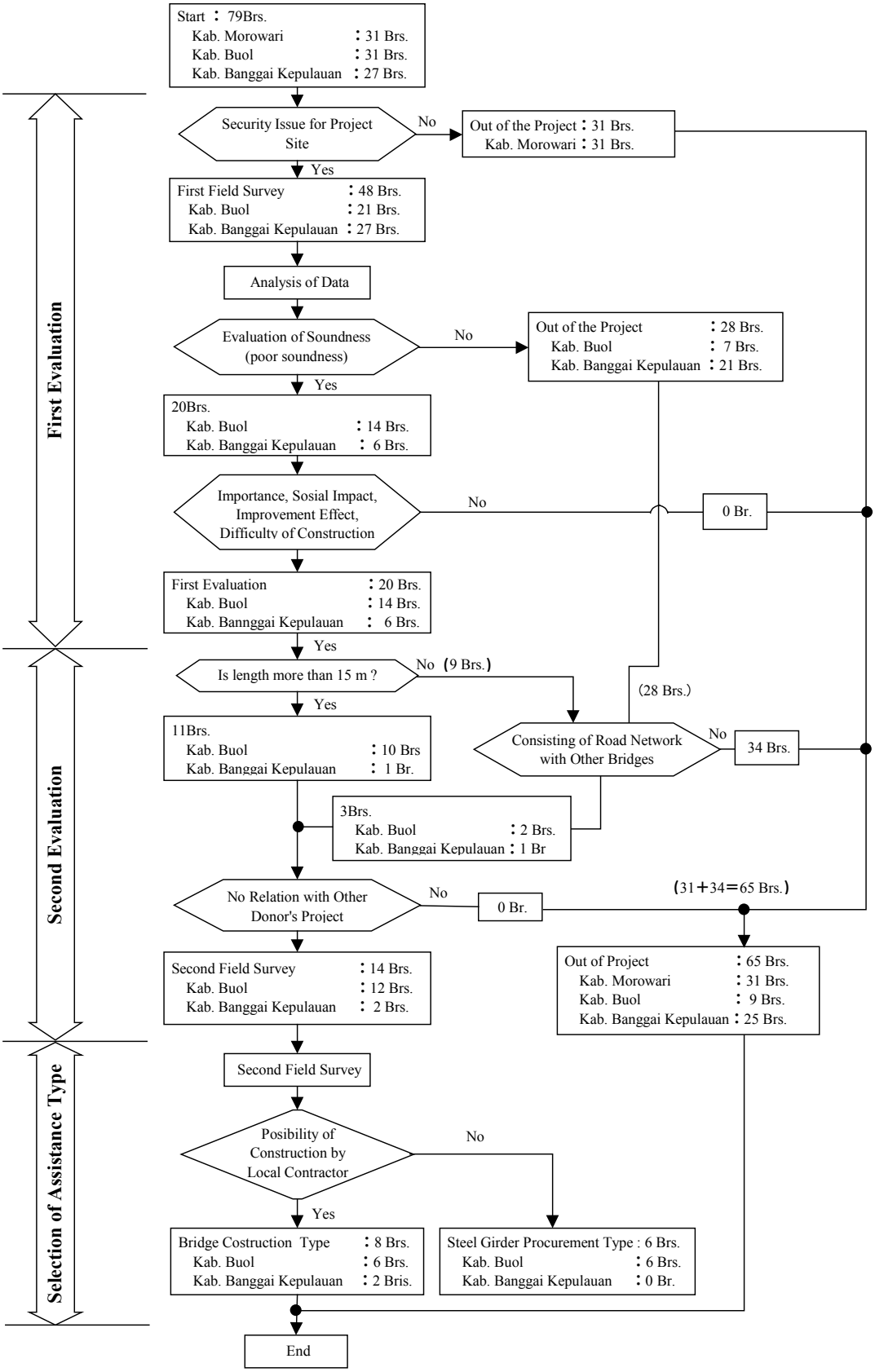


Figure 2-1 Flow Chart of Candidate Bridges Selection for Central Sulawesi

(2) Policies Based on Natural Conditions

1) Meteorological conditions

The area of Central Sulawesi involved in the study includes the two Kabupatens of Buol and Banggai Kepulauan.

Throughout the year there is no clear division between rainy and dry seasons. Buol's annual rainfall amounts to 4,000 mm, more than double of Banggai Kepulauan's figure of 1,800 mm.

Therefore Buol is prone to flooding, and two or three times a year experiences overflowing of local rivers, which at times inundates fields, roads, and even residential areas.

However, the water usually recedes within the span of a few hours, and communities are not isolated for long periods of time due to washed out roads.

The areas of North Sulawesi involved in the project, Kabupaten Minahasa and the city of Manado, is clearly divided rainy and dry seasons, the dry season being from April to November, and the rainy season being from December to March.

Due to these conditions, special consideration is taken in the implementation plan for bridges in North Sulawesi in particular.

2) River conditions

In neither Kabupaten of Central Sulawesi are found rivers with artificial bank protection. Therefore at certain locations in which the bridge is located along river bends, erosion occurs in times of flood and, as in the case of B6 Bridge, bridge foundations originally built on land have collapsed. Due to bank erosion, large trees have also often fallen into and drifted along the river, becoming destabilizing factors to some bridges.

In the areas around Poigar Bridge and Megawati Bridges in North Sulawesi, some artificial revetment has been installed, but in both cases, the upstream region has no artificial protection, thereby large trees sometimes fall into the river and destabilize the bridges downstream.

Furthermore, in both Central and North Sulawesi, sand and gravel quarries are highly active in the river areas, lowering the level of the riverbed and as a result are a major cause of damage by scouring.

In planning bridges, height of free board to avoid damage by floating wood, embedded depth of piers within river, and installation of revetment as a countermeasure to erosion of land foundations were all studied.

Furthermore, flood erosion countermeasures for grade fill of access roads were also studied.

3) Geological conditions

The project bridges of Kabupaten Buol in Central Sulawesi are located in an alluvial region, the ground consisting of uncompacted sediments of gravel, sand and clay.

The project bridges in Kabupaten Banggai Kepulauan, located along the outer edge of the island, are located in an alluvial area consisting of uncompacted sediments of gravel, sand and clay.

The project bridges of North Sulawesi are located in an alluvial region, the ground consisting of uncompacted sediments of gravel, sand and clay.

The outline of soil investigation result is shown in Table 2-2.

Based on the soil investigation result, foundation of substructure will select direct foundation, bearing pile foundation or friction pile foundation.

Table 2-2 Outline of Soil Investigation Result

Bridge No.	Borehole No.	Contract Driling Length (m)	Actual Drilling Length (m)				Undisturbed Soil Sampling (Nos.)	Disturbed Soil Sampling (Nos.)	Standard Peneteration Test (Nos.)	Remarks
			Soil Formation	Gravelly Soil	Rock Formation	Total Length				
Central Slawesi										
B4	B4-1	15.00	35.45	0.00	0.00	35.45	3		33	on land
B6	B6-1	15.00	21.45	14.00	0.00	35.45	1	1	35	on land
	B6-2	15.00	22.45	8.00	0.00	30.45	2		28	on river
	B6-3	15.00	30.45	5.00	0.00	35.45	1		34	on land
B8	B8-1	15.00	16.00	0.00	3.00	19.00	3		19	on land
B10	B10-1	15.00	9.00	0.00	6.01	15.01	1		14	on land
B11	B11-1	15.00	35.45	0.00	0.00	35.45	3		30	on land
B12	B12-1	15.00	28.00	3.45	0.00	31.45	1		30	on land
	B12-2	15.00	32.45	3.00	0.00	35.45	1		34	on river
	B12-3	15.00	35.45	0.00	0.00	35.45	1	1	35	on land
B13	B13-1	15.00	40.45	0.00	0.00	40.45	1		40	on land
	B13-2	15.00	35.45	0.00	0.00	35.45	2		33	on river
	B13-3	15.00	35.45	0.00	0.00	35.45	2		35	on land
B17	B17-1	15.00	28.00	4.15	0.00	32.15	2		29	on land
	B17-2	15.00	28.00	3.65	0.00	31.65	2		28	on land
B18	B18-1	15.00	26.45	0.00	0.00	26.45	1		25	on land
B19	B19-1	15.00	35.45	0.00	0.00	35.45	3		33	on land
B21	B21-1	15.00	14.95	6.50	0.00	21.45			21	on land
	B21-2	15.00	3.00	12.06	0.00	15.06			15	on river
	B21-3	15.00	30.45	5.00	0.00	35.45	1		35	on land
S26	S26-1	15.00	35.45	0.00	0.00	35.45	3		32	on land
	S26-2	15.00	35.45	0.00	0.00	35.45	2		33	on land
Sub Total		330.00	614.70	64.81	9.01	688.52	36	2	651	
North Slawesi										
Megawati	MG-BH1	15.00	11.30	1.90	2.25	15.45	1	4	15	on land
	MG-BH2	15.00	9.40	0.85	0.00	10.25		2	10	on river
	MG-BH3	15.00	10.33	0.00	0.00	10.33		1	10	on river
	MG-BH4	15.00	16.45	0.00	0.00	16.45		1	16	on land
Poigar	PG-BH1	15.00	2.11	1.87	6.03	10.01			4	on land
	PG-BH2	15.00	8.10	2.50	4.40	15.00		2	12	on river
	PG-BH3	15.00	20.70	3.10	3.32	27.12	2	4	21	on river
	PG-BH4	15.00	6.95	3.50	0.00	10.45		2	10	on land
Sub Total		120.00	85.34	13.72	16.00	115.06	3	16	98	
TOTAL		450.00	700.04	78.53	25.01	803.58	39	18	749	

4) Topographical conditions

The terrain surrounding the project bridges of Kabupaten Buol in Central Sulawesi is in general gentle, but as many of the rivers in the area are experiencing erosion induced by lowering of river bed level, the edges of the rivers tend to be steep.

The bridges in Kabupaten Banggai Kepulauan are located along the coastal causeway; a narrow plain area stretching along the coast characterizes the area.

A range of low mountains stretches from the area southwest of the Poigar Bridge in North Sulawesi.

Megawati Bridge is located within the city area of Manado, a flat terrain but crowded with residences.

Megawati is the only of these bridges, which requires consideration due to topographical and land use conditions. In order to avoid damage from vibrations to the surrounding residences, cast-on-site concrete piles, which would not involve vibrating, are to be adopted and a longitudinal bridge plan in consideration of the present road elevation was studied.

5) Seismic conditions

The archipelago of Indonesia forms a link in the seismic belt of the Pacific Rim, and is highly prone to seismic activity.

Most recently, an earthquake of magnitude 7.5 shook the area around the Banggai Islands in May 2000.

In light of this, Indonesia has set up guidelines for seismic considerations in bridge construction according to a region's potential seismic intensity, which will provide a base for basic seismic countermeasures.

(3) Policies regarding social conditions

This project involves the planning of replacement of existing. Due to the construction of access roads, which accompany bridge construction, there will arise situations in which new land will need to be acquired. This plan has been conducted so as to avoid the removal of residences that might be located in construction areas. Furthermore, in instances of replacement of existing bridges, the construction of detour routes and bridges will be necessary. In cases such as these, the level of service will be maintained by taking into consideration the existing state of traffic.

(4) Policies regarding construction technology

Bridge construction technology in Indonesia has improved dramatically through experience in construction of expressways in Jakarta and elsewhere, and through experience in joint ventures with Japanese and other foreign corporations. However, with the exception of a few large corporations, in reality most firms still are found lacking in the aspects of quality control, schedule management, and safety management.

In this project, bridge engineers from Japan will be sent to actively carry out technical transfer to Indonesian engineers.

(5) Policies regarding the use of local contractors, materials, and equipment

The implementation of public works in Indonesia changed early on from direct government management as often seen in developing countries to a system of contracting to private firms,

thus, there is a large number of large to small firms registered within the country. These construction contractors have acquired a large amount of construction machinery and equipment through the highway projects mentioned above.

Upon the implementation of this project, these construction contractors can be made use of as subcontractors, leasing agents of construction machinery and equipment, or as sources of manpower procurement.

Domestic construction materials will be divided between those, which can be produced domestically, and those, which are, imported items available on the domestic market. The former includes aggregates, cement, reinforcing steel, and the latter PC steel materials and additive agents.

(6) Policies regarding maintenance capabilities of the administering agency

All of the project bridges in Central Sulawesi are along Kabupaten roads. In Indonesia, the Kabupaten Governments carry out maintenance of Kabupaten roads, but as for the bridges in this project, in accordance with The Memorandum of Understanding (MOU) by the national and Central Sulawesi Provincial Governments, the bridges will be maintained by Central Sulawesi. Central Sulawesi has been maintaining all national and provincial roads and has proven to have an adequate level of maintenance skill.

The bridges in North Sulawesi are on national roads and will be maintained by North Sulawesi Provincial Government. North Sulawesi has been maintaining all national and provincial roads and has proven to have an adequate level of maintenance skill.

(7) Policies regarding the scope of bridge construction, scope of steel girder procurement, and grade

The scale and scope of the bridge and access road is decided upon after due consideration of the topography, geology, hydrology and traffic volume of the bridge in question, with a sufficient grasp of local flooding characteristics.

All project bridges within Central Sulawesi are located along Kabupaten roads, adopting the following grades:

- Design standard : Indonesia Bridge Design Standard
- Design Live Load : DT load (full loading)
- Bridge width : 4.5 m
- Road standard : Kabupaten road

All project bridges within North Sulawesi are located along national roads, adopting the following grades:

- Design standard : Indonesia Bridge Design Standard
- Design Live Load : DT load (full loading)
- Bridge width : 1.5 m + 0.5 m + 3.5 m × 2 + 0.5 m + 1.5 m = 11.0 m
- Road standard : National road

(8) Policies regarding atmospheric corrosion resistant steel materials

Indonesian side hopes procured girders that need not required repainting so as to minimize maintenance cost. Here, steel girders using atmospheric corrosion resistant steel help reduce maintenance costs, as they do not require repainting or recoating as ordinal steel girders do. All six (6) Component A bridges are located away from the coast where weather condition is also suitable to make stable rust and from major cities, making it relatively difficult to maintain through coating; therefore with consideration of Indonesian side request, atmospheric corrosion resistant steel material is chosen.

(9) Policies regarding construction schedule

The project areas within Central Sulawesi lack clearly defined rainy and dry seasons, tending towards a somewhat even rainfall year-round. Although working day ratio may be reduced due to raining, there are no constraints on the construction schedule due to natural conditions.

There are three bridges each of Component A and Component B in the Kokobuka area of Buol, totalling six (6). The procurement of means of crossing the river at B12, which corresponds to the gateway of the area, and B11 along the same alignment will greatly influence the construction schedule of four other bridges located further in. Therefore, the procurement of means of crossing at B12 and B11 should take priority in deciding the construction schedule of the four remaining bridges of the interior.

2-2-2 Basic Plans

(1) Establishment of Design High Water Level and Free Board

Design high water level was established the highest level either the peak flood discharge on 40 years return period high water level or recorded maximum flood level based on Indonesian standard.

The free board clearance is shown on Table 2-3 based on Indonesian standard.

Table 2-3 Free Board Clearances

River Width	Free Board	Remarks
Less than 10m	0.3 m	―
Grater than 10m	1.0 m	The vertical alignment of approach road has a constrain, the free board can reduce 0.8m.

The result of discharge of hydrological analysis and recorded maximum flood level for the Project Bridges are shown on Table 2-4.

As shown on Table 2-4, the flood discharge of forty (40) years return period by hydrological analysis and recoded maximum flood discharge are approximately same discharge. It is noted that two (2) years return period high water level by hydrological analysis, which will use temporary works under the construction stage, is similar to recorded maximum flood level.

Table 2-4 Design High Water Level and Free Board Clearance

Br. No.	Bridge Name	Design Bridge Length (m)	Catchment Area (km2)	Peak Flood Discharge to the Return Period (m3/sec)					Velocity at Survey Stage	Recorded Maximum Flood			Design High Water Level	Free Board	2 Years Return Period High Water Level
				Return Period (Year)						Flood Water Level	Flood Discharge	Equivalent Return Period			
				2	10	20	40	50	(m/sec)	(EL.m)	(m3/sec)	(Year)	(EL.m)	(m)	(EL.m)
Central Sulawesi：Kab. Buol															
B4	Pujimulyo	25	33.0	33	40	46	48	50	0.9	17.79	48	40	17.79	1.0	17.09
B6	Kokobuka I	80	1,400.0	1,500	1,700	1,800	1,900	2,000	2.3	25.90	1,900	40	25.90	1.0	24.38
B7	Kokobuka II	10	7.0	7	8	9	10	10	0.3	26.25	10	40	26.25	0.3	25.65
B8	Kokobuka III	20	1.9	2	2	2	3	3	0.8	27.70	3	40	27.70	1.0	25.87
B10	Kokobuka V	15	7.0	7	8	9	10	10	0.7	31.08	10	40	31.08	1.0	30.78
B11	Kokobuka VI	21	2.0	2	2	2	3	3	2.5	26.37	3	40	26.37	1.0	22.77
B12	Kokobuka VII	60	53.0	56	64	66	72	77	2.5	21.74	70	40	21.74	1.0	20.94
B13	Bunkudo I	42	460.0	480	550	580	620	670	1.0	9.00	610	40	9.00	1.0	8.69
B17	Tayadun II	20	18.0	19	22	22	24	26	0.7	21.33	24	40	21.33	1.0	20.53
B18	Tayadun III	20	18.0	19	22	22	24	26	0.8	21.98	24	40	21.98	1.0	21.48
B19	Bonobogu I	20	0.0	0	0	0	0	0	0.8	11.11	―	Irrigation Cannel	11.11	1.0	10.11
B21	Matinan	50	30.0	32	36	38	41	44	1.5	10.15	40	40	10.15	1.0	9.05
Central Sulawesi：Kab. Banggai Kepurauan															
S26	Patukuki I	42	0.0	0	0	0	0	0	0.0	2.92	0	Tidal River	2.92	1.0	N/A
S27	Patukuki II	6×4	0.0	0	0	0	0	0	0.0	2.92	0	Tidal River	2.92	0.3	N/A
North Sulawesi															
3	Poigar	120	300.0	230	370	400	420	430	0.7	13.70	420	40	13.70	1.0	12.19
4	Megawati	87	200.0	160	240	270	280	290	0.0	8.32	280	40	8.32	1.0	7.32

(2) Plan and Design for Bridges

1) Superstructure Type

i) Bridge Construction Type (Component B)

<u>Central Sulawesi;</u>

Since bridge length are assumed to range from 30 m to 80 m in this project, an appropriate span for the proposed bridges will be from 20 m to 30 m in consideration with economic

aspect and the previous experience in Indonesia. Therefore, post-tensioned PC girder type will be appropriate for this project. However, box culvert will be appropriate for Patukuki II Bridge because short span length 5 m in consideration with economic aspect and construction aspect.

North Sulawesi;

Megawati Bridge will be cast -in-site PC hollow slab type for the following reasons:

- Vertical alignment of approach road has a constrain by closed at-grade intersection. Therefore, thickens of superstructure is limited.
- The existing substructures are caisson foundation, the total removal of which is extremely difficult. Therefore, the span arrangement is planned to avoid the pre-existing substructure.
- Although it is possible to procure a manufacturing yard near the bridge site, shipping of the girder to the site would be complicated; also, sufficient space for erection yard is not available, therefore a pre-cast girder is impractical.
- Implementation of staging within the river is made possible by making use of the existing pier foundations and newly built piers.
- If 24 m spans make staging implementation possible, cast-in-site PC hollow deck type bridge would be the most economic superstructure type.

Poigar Bridge has begun to sink at an incline due to scouring of P1 pier and an overlay of concrete has been implemented to the crown of the existing pier. Scouring is likely to occur again in the future and as a permanent measure the construction of the new P1 pier is necessary.

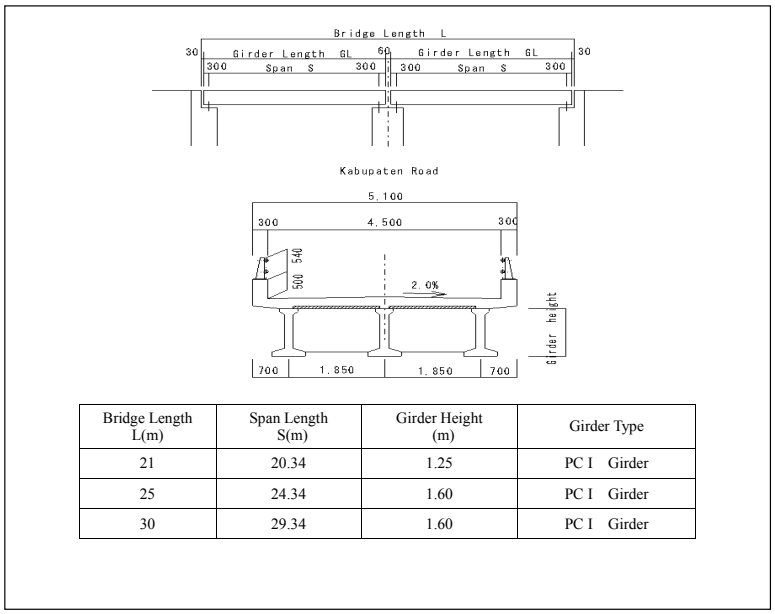
In constructing the new pier, without stopping normal traffic, existing pier is removed while the bridge rests on temporary supports, and new pier is constructed. Furthermore, in order to avoid excess stress on the existing girder, the existing steel girders between the temporary supports will be removed. A temporary truss bridge will be set up for the duration of the construction to keep traffic flowing freely.

P2 and P3 piers are not sinking, but signs of scouring have been found. Riprap work will be placed to prevent further scouring.

Standard bridge drawings according to Bridge Construction Type by Japanese Grant Aid are shown in Figure 2-2 and Figure 2-3.

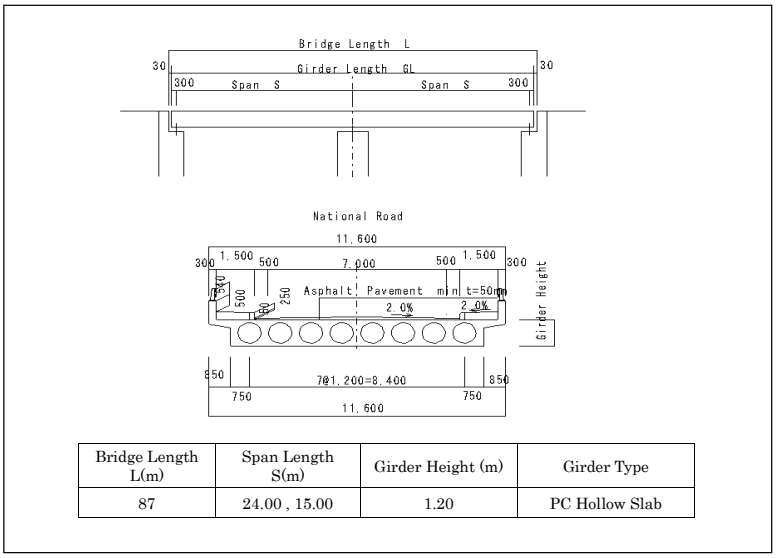
ii) Steel Girder Procurement Type (Component A)

H-type steel girder is adopted for superstructure types with span length below 20 m, for reasons of experience and economics. Standard bridge drawings according to Steel Girder Procurement Type by Japanese Grant Aid are shown in Figure 2-4.



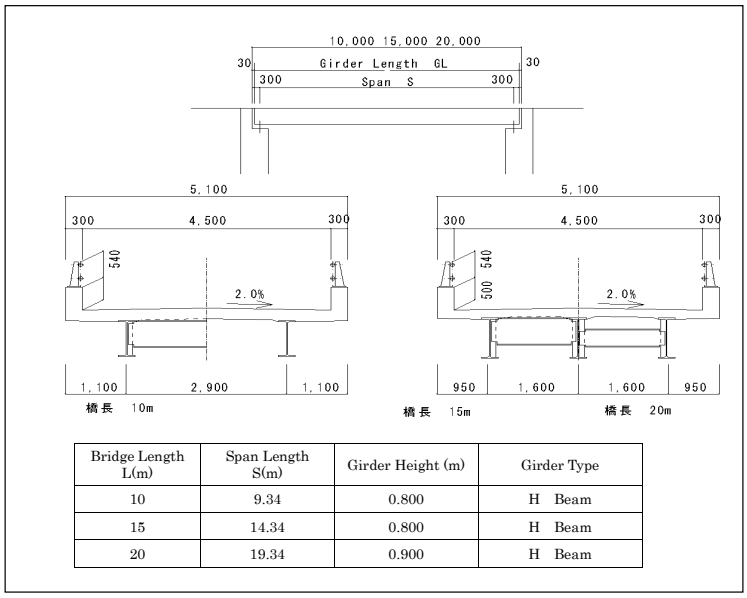
Bridge Length L(m)	Span Length S(m)	Girder Height (m)	Girder Type
21	20.34	1.25	PC I Girder
25	24.34	1.60	PC I Girder
30	29.34	1.60	PC I Girder

Figure 2-2 General Drawing of PCI Section Girder Bridge for Bridge Construction Type



Bridge Length L(m)	Span Length S(m)	Girder Height (m)	Girder Type
87	24.00 , 15.00	1.20	PC Hollow Slab

Figure 2-3 General Drawing of PC Hollow Slab Bridge for Bridge Construction Type



Bridge Length L(m)	Span Length S(m)	Girder Height (m)	Girder Type
10	9.34	0.800	H Beam
15	14.34	0.800	H Beam
20	19.34	0.900	H Beam

Figure 2-4 General Drawing of H-Type Steel Girder Bridge for Steel Girder Procurement Type

2) Substructure Type

i) Substructure

Substructure type was determined as shown in Table 2-5.

Table 2-5 Substructure Type

Parts	Type	Reasons of a selection
Abutment	Cantilever	Most economical structural type
Pier	Wall type	Minimized river blocking and low possibility of scouring
Foundation	Direct foundation	To be employed in cases of shallow supporting ground with sufficient carrying strength.
	Piles foundation	The supporting stratum in Central Sulawesi is in general deep; friction pile of about 20 m frictionally supported by a clay stratum with a N value of approximately 10 is thus selected for reasons of economy and ease in implementation. From the point of view of implemented length, reliability of joints, and manufacturing schedule, the pile type used is to be a steel pipe pile of φ400 mm. In North Sulawesi there appears relatively shallow supporting stratum. In consideration to the presence of mosque and residences in the vicinity and dependability in situations of hard ground, a cast-in-place pile of φ1000 mm is to be used.

ii) Embedment of pier

The rivers of Central Sulawesi are winding and flow rapidly, and while the rivers of North Sulawesi tend to be more gentle, significant scouring in the riverbed occurs. Therefore, it is necessary to find an appropriate embedment depth for the design of piers within the river.

The hydrological analysis shows the maximum scouring depth of the pier as the relative equation "H_0/ and Zs/D"

$Zs/D = f [H_0/D,(Ns \cdot d/D),S]$

Where; Zs = Maximum local pier scour depth (m)
D = Bridge pier width
H_0 = Average water depth (m)
d = Average size of dune (sand) (mm)
Ns = Sediment number
S = Coefficient for type of pier (0.8)

If, Ho = 1.5 m and D = 1.5 m the $Zs/D = 1.5 \times 0.8 = 1.2$,

the maximum scouring depth being 1.8 m.

As reference, pier embedment in such cases in Japan, according to the River Facilities Structure Regulation, is 2.0 m.

Therefore, an embedment depth of 2.0 m below the present riverbed will be acquired for the pier within the river. Gabion mats is provided around abutments and riprap is provided around piers.

iii) Placement of Abutment

Determination of bridge length includes consideration of a three-meter setback from both shoulders of the river.

The concept of the setback is shown in Figure 2-5.

- The existing river is a natural river with much erosion. Therefore, gabion mats protect the riverbank as counter measure against retreat of the riverbank by erosion.
- The bridge length is decided with consideration to the predicted line of bank collapse because main soil of natural ground is rose sand. The riverbank is

assumed as stable by gabion mats bank protection. Therefore, the predicted line of bank collapse is considered to be the three-meter setback point from the shoulder and line connecting it with the foot of the bank. As a result, the hypothetical gradient of collapsed bank is between 1:1 to 1:2, and this slope is rather gently than 1:1 of active collapse slope, therefore, 3.0 m set back is confirmed for safety sake.

- In construction of the abutment, care is taken not to alter the existing river cross section. The total of the bridge seat width + toehold length + sheet pile cofferdam clearance is 3.0 m, and the cofferdam cross section roughly matches the revetment shoulder.

- The sole plate of the abutment is set below the hypothetical bank collapse line in order to provide stability in the event of future erosion.

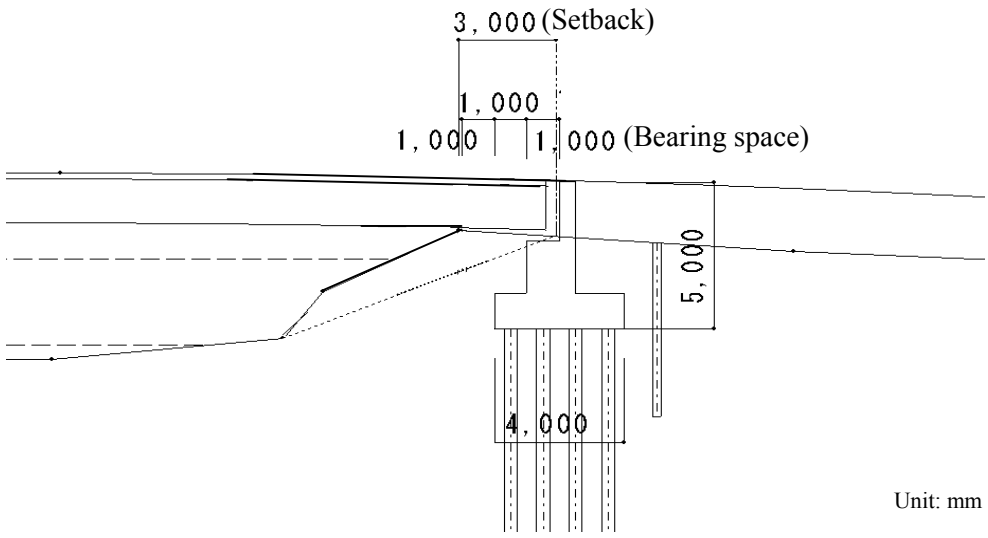


Figure 2-5 Setback of Abutment

(3) Design Condition for Bridges

i) Establishment of Design Standards

As a rule, the basic design will be carried out according to the Indonesian standards and where certain items are not clarified, Japanese design standards (Specifications for Highway Bridges) will be adapted. (Peratuan Perncanan Teknik Jembatan; 1992)

ii) Design Method

The design of structural members will follow Specifications for Highway Bridges (Japan), in accordance with Allowable Stress Design Method and checked its result by Limit State Design Method.

iii) Width of Bridge and Approach Road

The width of the bridge and the approach road were agreed upon as the result of discussion with the Indonesian side based on road category and field survey.

The Typical Cross Sections are shown on Figure 2-6 and Figure 2-7.

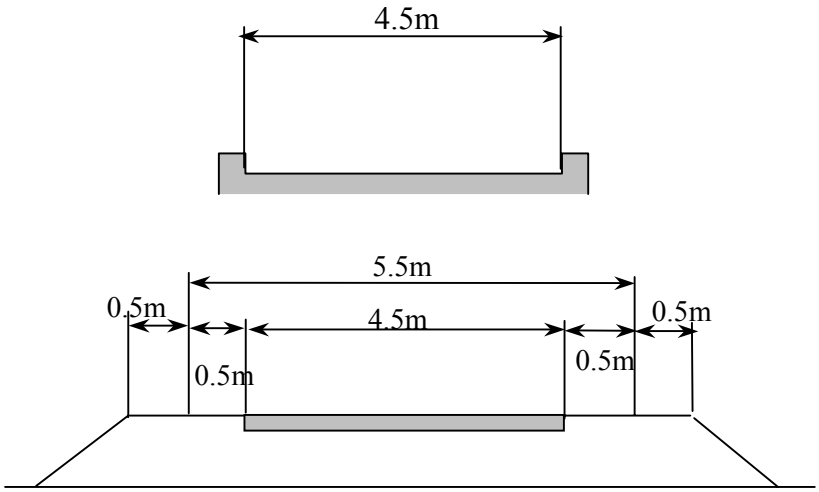


Figure 2-6 Kabupaten Road Width

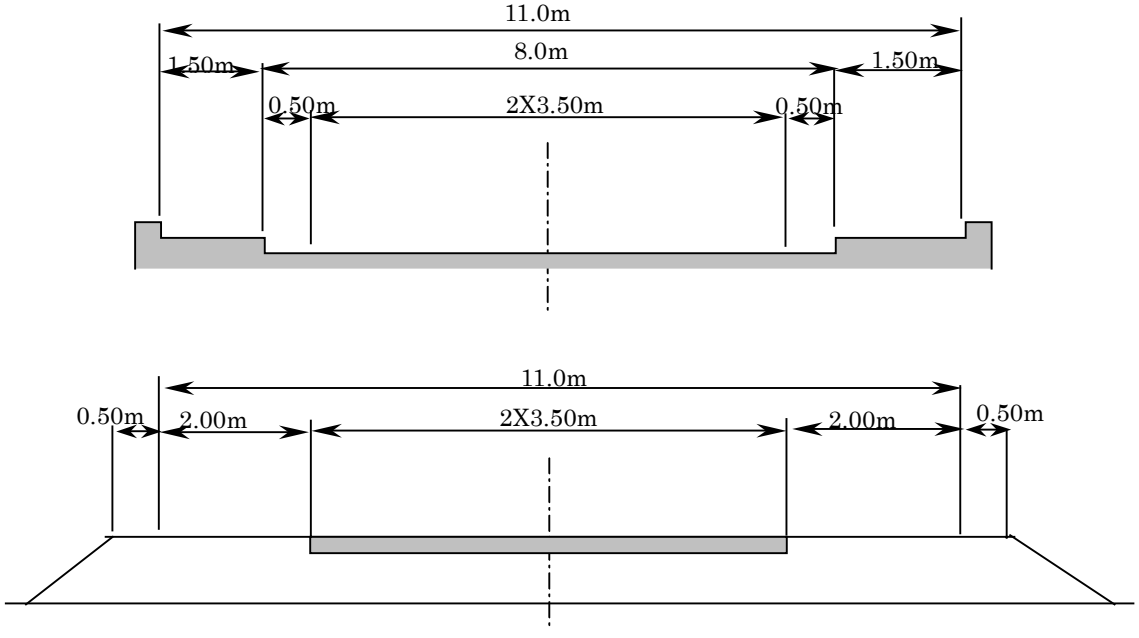


Figure 2-7 National Road Width

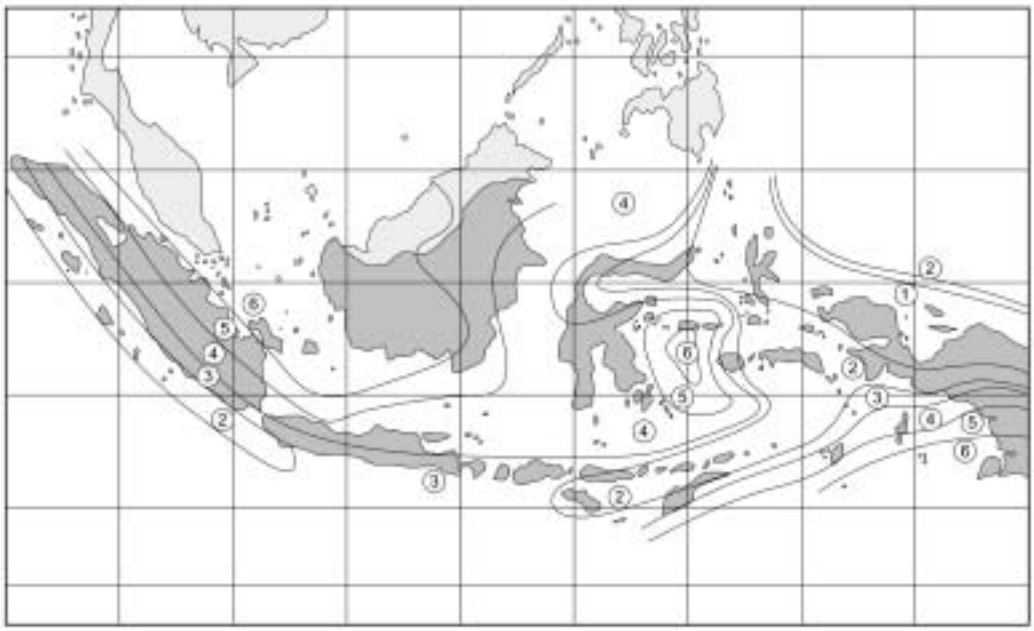
iv) Design Load

1. Live load

The design live load applies 100% of the Live Load of the Indonesian Standards.

2. Seismic load

Design seismic load was established based on the Seismic Coefficient Areas Classification Map (refer to Figure 2-8) in the Indonesian standards.



Area	Classification
Manado	①
Minahasa	②
Buol	③
Banggai Kepulauan	③

Figure 2-8 Seismic Coefficient Areas Classification Map

v) Design Criteria

1. Unit weight of materials

Table 2-6 Unit Weight of Materials

Material	Unit weight kN/m^3	Material	Unit weight kN/m^3
Steel	77.0		
Reinforced concrete	24.5	Asphalt pavement	22.5
Pre-stressed concrete	26.0	Concrete pavement	23.0
Plain concrete	23.0	Timber	8.0

2. Material strength

Table 2-7 Design Strength of Concrete

Name of structure	Strength (N/mm^2)
PC girder (post-tension)	40
Deck slab	29
Abutment, pier	21
Concrete pile	30

Table 2-8 Strength of Reinforcement bar

Type of reinforcement bar	Yield strength
Round bar (A-I)	σpy=190
Deformed bar (A-II)	σpy=240

Table 2-9 Tensile Strength of Steel

Type of steel	Tensile Strength (N/mm^2)	Remarks
SS400, SM400	410 - 520	
(SM490, SM490Y)	500 - 620	
(SM520)	530 - 650	
SMA400W	410 - 550	Atmospheric corrosion resistant steel
(SMA490W)	500 - 620	Atmospheric corrosion resistant steel

Numbers in parentheses ( ) are not used except in special situations

3. Road geometric structure standards

Road geometric structure standards comply with Indonesian standards shown as below.

Table 2-10 Road Geometric Structure Standards

Description		Unit	North Sulawesi		Central Sulawesi
Road classification			National Road		Kabupaten Road
Construction area			Rural area	Urban area	Rural area
Design speed		Km/hr	80	60	40
Geometric element					
Minimum radii		m	210	110	50
Minimum transition curve length		m	70	50	35
Minimum radius not requiring transition section		m	900	500	250
Minimum radius not requiring super elevation		m	3500	2000	800
Vertical element: Maximum gradient		%	5.0	8.0	10.0
Maximum vertical curve length	Crest	m	Standard: $L = (A \times S^2)/405$		
	Sag	m	Standard: $L = (2 \times S) - 405/A$		

Note: In cases where Kabupaten road is to be used as access road, the existing alignment of the Kabupaten road takes priority in order to minimize the necessity of resettlement and amount of land area to be acquired.

4. Revetment and Bed Protective Works

Since no bank has the project area river, mat gabions were adopted around abutment to avoid scoring. However, A sheet pile revetment was applied for Kokobuka I Bridge (B6) due to big scale of river and current severe scoring conditions. A riprap work was applied as bed protective works around pier to protect scoring.

The slope protection of approach road is applied by sodding to protect flooding.

2-2-3 Basic Design Drawings

Basic Design Drawings are shown at the end of this volume. The outline of design result is shown on Table 2-11.

Table 2-11 Outline of Bridge Design

Br. No.	Bridge Name	Bridge Length (m)	Superstructure	Abutments	Piers	Approach Road Length (m)	Component Type
B4	Pujimulyo I	25.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=20	N/A	123.8	B
B6	Kokobuka I	25.0+30.0+25.0=80.0	PC-I Girder	T- Type×2 Steel Pile (Friction Pile) φ40cm L=18m & L=15m N=20	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=20	143.0	B
B7	Kokobuka II	10.0	H-Beam	T-Type×2 Direct foundation (Additional soil investigation will be required by Indonesian side)	N/A	67.7	A
B8	Kokobuka III	20.0	H-Beam	T-Type×2 RC Pile (Bearing Pile)	N/A	87.7	A
B10	Kokobuka V	15.0	H-Beam	Gravity Type×2 Direct foundation	N/A	112.9	A
B11	Kokobuka VI	21.0	PC-I Girder	T- Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=12	N/A	154.1	B
B12	Kokobuka VII	30.0+30.0=60.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=20	T-Type×1 Steel Pile (Friction Pile) φ40cm L=20m N=20	474.0	B
B13	Bungkudu I	21.0+21.0=42.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=12	T-Type×1 Steel Pile (Friction Pile) φ40cm L=20m N=16	128.7	B
B17	Tayadun II	20.0	H-Beam	T-Type×2 RC Pile (Friction Pile)	N/A	158.0	A
B18	Tayadun III	20.0	H-Beam	T-Type×2 RC Pile (Friction Pile)	N/A	154.0	A
B19	Bonobogu I	20.0	H-Beam	T-Type×2 RC Pile (Friction Pile)	N/A	86.9	A
B21	Matinan	25.0+25.0=50.0	PC-I Girder	T- Type×2 Direct foundation & Steel Pile (Friction Pile) φ40cm L=20m N=20	T-Type×1 Direct Foundation	129.7	B
S26	Patukuki I	21.0+21.0=42.0	PC-I Girder	T-Type×2 Steel Pile (Friction Pile) φ40cm L=20m N=12	T-Type×1 Steel Pile (Friction Pile) φ40cm L=20m N=15	108.2	B
S27	Patukuki II		Box Culvert (6×4 m)			72.7	B
North Sulawesi							
3	Poigar	(120m)	Pier replacement and riprap work		T-Type×1 Direct foundation	87.3	B
4	Megawati	24.0+24.0+24.0+15.0 =87.0	PC-Hollow Slab	T- Type×2 Direct foundation & Bored Pile (Bearing Pile) φ100cm L=11m N=8	T- Type×3 Direct foundation & Bored Pile (Bearing Pile) φ100cm L=7m N=8	-	B

Note: Component Type A=Steel Girder Procurement Type, Component B=Bridge Construction Type

2-2-4 Implementation Plan

2-2-4-1 Implementation Policies

(1) Implementation Organization by Recipient Country

The Government of Indonesia intends to implement this project to compose the steering committee. And the Minister of Settlement and Regional Infrastructure nominate a government staff as the Project Managers for Central Sulawesi and North Sulawesi. The members of steering committee are shown on Table 2-12. The organization chart is shown on Table 2-9.

Table 2-12 Member of Steering Committee

	MEMBER OF STEERING COMMITTEE	ASSIGNMENT
①	DIR. GEN. OF REGIONAL INFRASTRUCTURE	CHAIRMAN
②	DIR. OF TECHNICAL AFFAIR	SECRETARY
③	DIR. OF EASTERN REGIONAL INFRASTRUCTURE	Member
④	DIR. OF PLANNING AND FOREIGN COOPERATION BUREAU	Member
⑤	DIR. OF REGIONAL AND TRANSMIGRATION (BAPPENAS)	Member
⑥	DIR. OF TRANSPORTATION (BAPPENAS)	Member
⑦	DIR. OF EXTERNAL FUND (MOF)	Member
⑧	DIR. OF SYNCHRONIZATION OF REGIONAL DEVELOPMENT (MOHA)	Member
⑨	CHIEF OF BAPPEDA, NORTH SULAWESI PROVINCE	Member
⑩	CHIEF OF BAPPEDA, CENTRAL SULAWESI PROVINCE	Member
⑪	CHIEF OF DINAS KIMPRASWIL, NORTH SULAWESI PROVINCE	Member
⑫	CHIEF OF DINAS KIMPRASWIL, CENTRAL SULAWESI PROVINCE	Member
⑬	CHIEF BAPPEDA BUOL, CENTRAL SULAWESI PROVINCE	Member
⑭	CHIEF BAPPEDA BANGGAI, CENTRAL SULAWESI PROVINCE	Member

BRIDGE CONSTRUCTION FOR REGIONAL DEVELOPMENT IN THE CENTRAL AND NORTH SULAWESI PROJECT ORGANIZATION

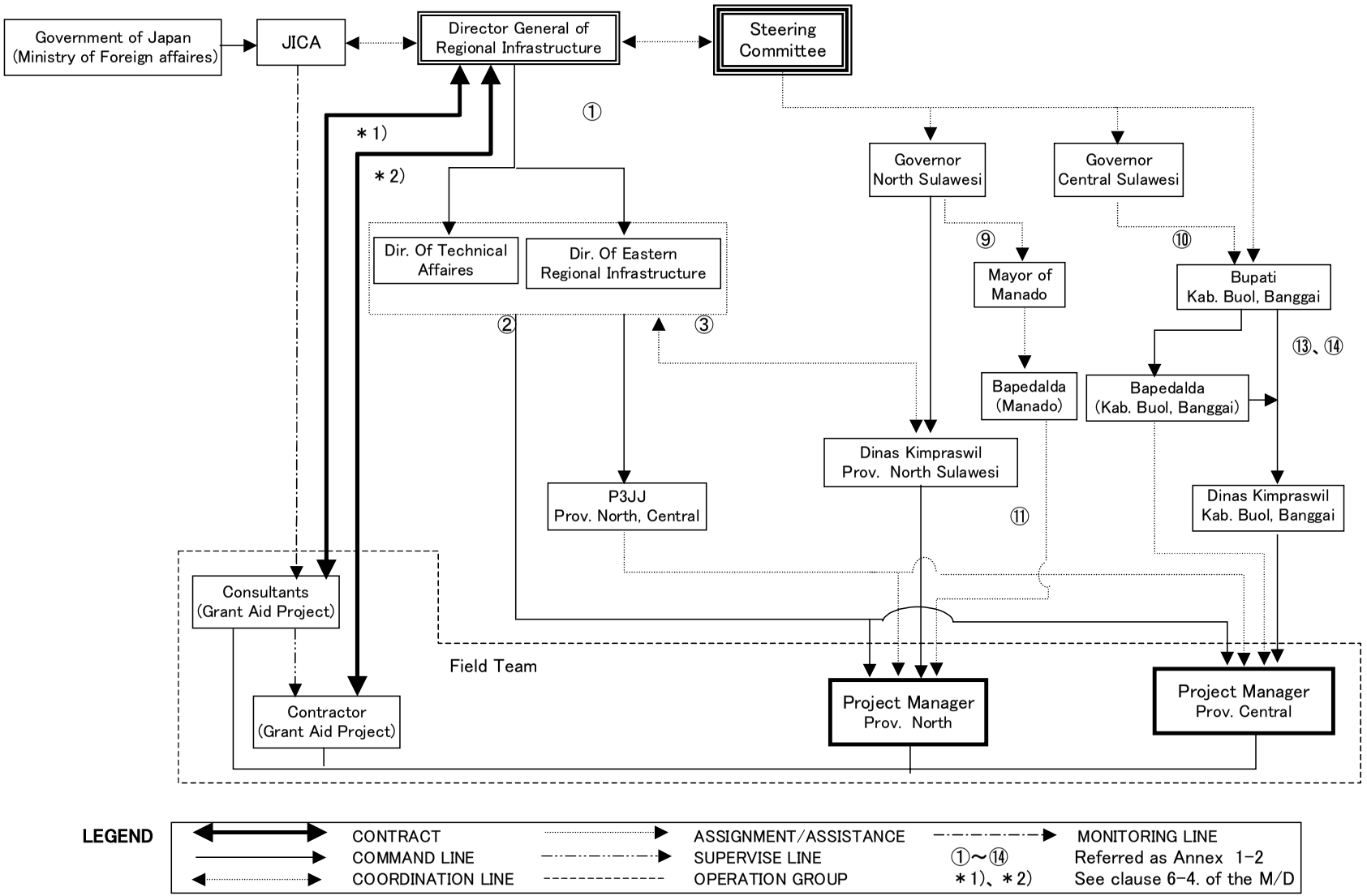


Figure 2-9 Organization Chart for Implementation of the Project

(2) Bridge Construction Type (Component B)

1) Policies Regarding Implementation Plan

1. This Project scatter throughout three Kabupatens and one city in Central and North Sulawesi. Therefore, the ten (10) bridges are divided into the two based on the implementation organization of the Indonesian side making the construction plan.

Table 2-13 Bridge Groupings

Province	Kabupaten, City	Area (Desa)	No. of bridge
Central Sulawesi	Buol	Kokobuka	B4, B6, B11, B12
		Bungkudo, Matinan	B13, B21
	Banggai Kepurauan	Patukuki	S26, S27
North Sulawesi	Mando	Manado	N4
	Minahasa	Poigar	N3

2. The implementation of construction organization shall involve Indonesian engineer to minimize construction cost and to implement technical transfer.

3. Experienced local contractors will be employed as the sub contractor, which will take place in scattered areas; therefore the main contractor will employ local contractors separately at each construction sites in provinces or Kabupaten, thereby promoting the active use of local contractors and contributing to technological transfer.

4. The main office for contractor(s) will set up Buol and Manado.

(3) Steel Girder Procurement Type (Component A)

This project involves the procurement of steel girders to be used in the construction of six (6) bridges in Buol, Central Sulawesi. The implementation policies of this procurement, administered as a grant aid cooperation project, are drawn up as follows:

- The procurement of steel girders is determined, by bridge, according to detailed design of each bridge's superstructure by the Japanese consultant.
- Since each steel girder erection site is far from the coastline, the utilization of weather proofing steel materials is possible and effective in reducing maintenance costs, therefore weather proofing steel materials are to be used.
- The delivering agent of the steel girders is responsible for manufacturing of the steel girders, cargo loading, shipping (by sea), and other transportation involved within Indonesia. The materials are to be handed over to the proper authorities at the designated stockyard in Buol.
- The Indonesian side is to transport the delivered steel girders to the erection site where they are to be used in the bridge construction.

2-2-4-2 Implementation Conditions

This project is mainly a bridge construction project. As a result of comparative studies of implementation criteria, maintenance and construction costs, the bridge types adopted are PC girder type, PC slab type, and for small-scale, Box culvert type. Substructure type is RC cantilever type abutment with wall-type pier and direct foundation or steel pipe pile foundation. An exception is Megawati Bridge, located within an urbanized area, for which cast-in-site concrete pile is adopted in order to mitigate vibration impact to the surrounding residences. Furthermore, Poigar Bridge's construction involves the reconstruction of one of the piers. A temporary bridge will permit normal traffic after the pier in question and the part of the superstructure above it are removed. Based on the above, the following are special considerations in regard to this project:

- At construction sites in Indonesia where steel pipe piles are welded, most instances employ "butt welding" without a joint preparation. Therefore, a full penetration welding method with a joint preparation will be employed to ensure joint strength. Furthermore, in order to guarantee quality of on-site welding of steel pipe piles, tests of the welded pile will be made using an ultrasonic flaw detector. Thus the results of the tests will be compared against the appearance of the welded joint to grasp the shape of welded bead, which has been confirmed as effectively welded. In order to meet the construction schedule which entails the completion of bridges over several scattered locations; schedule management, quality control, management of materials/equipment and labor procurement by the construction contractor, and construction supervision by the consultant are extremely important.
- In order to prevent labor-related accidents on site, safety training for workers and other safeguards equivalent to those in Japan will be carried out.
- It is also necessary to take into due consideration safety measures for passing traffic and local residents.
- To avoid lowering the standards of road service to local citizens, discussion will be made with the road owners and detour bridges and temporary roads will be included as part of the construction where necessary. Temporary bridges and roads will be regularly maintained to guarantee traffic safety.

2-2-4-3 Scope of Works

For the implementation of the Project under the Grant Aid of Japanese Government, work shall be shard by the Japanese and Indonesian Governments as described hereafter.

(1) Bridge Construction Type (Component B)

i) Responsibilities to be borne by Japanese Government

- Marine (Air) transportation of the products from Japan to the recipient country
- Internal transportation from the port of disembarkation to the project site
- Construction of bridges, access roads, and revetment
- Removal of existing bridges and installation of detour routes (where new bridge and existing bridge are at same alignment)
- Installation and removal of temporally jetty roads necessary for the construction work
- Installation and removal of construction camps and working yard
- Procurement of materials/equipment and labor necessary for construction
- Site supervision of Construction
- Consultant services for commencement of bridge construction type

ii) Responsibilities to be borne by Indonesian Government

- To secure land for bridges, connecting roads, temporary offices, and storage yard and take responsibility for demolition of all obstacles, if necessary.
- To clear, level and reclaim the site before commencement of the construction when needed
- To construct gates and fence in and around the site when needed
- To bear the following commissions to Japanese bank for the banking services based upon the B/A

  - Advising Commission of A/P
  - Payment Commission

- Tax exemption and customs clearance of product at the port of disembarkation
- To accord Japanese juridical and physical nationals, whose services may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work
- To exempt Japanese juridical and physical nationals engaged in the Project from customs duties, internal taxes including Value Added Tax (VAT), and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract
- To maintain and use properly and effectively the function the facilities constructed and equipment provided under the Grant Aid
- To bear all the expense, other than those to be borne by the Grant Aid, necessary for construction of the facilities

(2) Steel Girder Procurement Type (Component A)

i) Responsibilities to be borne by Japanese Government

- Procurement steel girders and materials include all of the following: main girder, cross girder, splices plates, bolts and nuts, shoes.
- Marine transportation of procured steel girders and materials from Japan to disembarkation port in Indonesia.
- In land transportation of procured steel girders and materials from disembarkation port to stockyard.
- Necessarily consultant works in the execution of this project:

  Scope of consultant works is detailed design of steel girder superstructure, receiving inspection and acceptance of steel girders and materials.

ii) Responsibilities to be borne by Indonesian Government

- Transport of procured steel girders and materials from stockyard to construction site.
- Construction of bridge superstructure with procured steel girders and materials.
- Design and construction of bridge substructure, access road and revetment.
- Removal of existing bridges and construction of temporary detour bridges.
- Construction and removal of camps and yards set up for bridge construction.
- Procurement of materials/equipment and labor necessary for above-stated construction.
- Site supervision of the above-stated construction.
- Acquisition of land for construction site, tenancy of camps, work yards and land for temporary roads.
- Compensation for acquired lands and resettlement.
- Removal/relocation of obstructions such as electric power lines, telephone lines and water pipelines.
- Exemption of tax and prompt customs clearance for imported materials and equipment.
- Exemption of customs duties, internal taxes and other fiscal levies which imposed in Indonesia with respect to the supply of the products and services from Japanese nationals and citizens of third countries involved with this project.

2-2-4-4 Consultant Supervision

(1) Basic policies of detailed design and supervision of construction

1) Detailed design

The basic policies of the detailed design are as follows:

- The contents of the field survey in the detailed design stage include site confirmation based on the basic design, supplementary survey in relation to implementation / estimations, and additional topographical / geological survey. In addition, final discussion will be conducted with concerned authorities of the Indonesian government regarding various items to be confirmed for the detailed design.
- Following the completion of detailed design in Japan, explanations and discussion with the concerned Indonesian authorities regarding the contents of the detailed design will be conducted.

2) Construction supervision

The basic policies of construction supervision are as follows:

- In order to reduce costs of construction supervision, as well as to promote the transfer of technology, local engineers will form the core of the supervising system.
- As the construction sites are spread over a wide area, each construction site will set up its own site office. Local engineers will stay at the respective site office supervising the site on a daily basis. A resident Japanese engineer based in Manado will make regular rounds to each sites and supervise the sites by practical use of local engineers. For construction of superstructure, two Japanese superstructure engineers will be stationed one each at Buol and Manado and will make rounds to sites in Central and North Sulawesi respectively, supervising the sites by practical use of local engineers.
- In order that the ten (10) bridges are completed within schedule, schedule management becomes the focus of construction supervision.
- A support system for the project will be established in Japan.
- Technological transfer is aimed not only at local engineers, but government authorities and construction contractors as well.

3) Details of construction supervision

Supervising engineers sent to Indonesia, along with advising local engineering staff, will carry out the following works:

- Approve construction planning, and working drawings

  Judges whether or not construction plans, construction schedule and implementation drawings submitted by contractor meet with those in the contract documents (which includes contract, specifications and design drafts) and grants approval.

- Schedule supervision

  Receives reports from contractor regarding construction progress and gives necessary direction to assure completion meets schedule.

- Quality inspection

  Inspects quality of construction materials brought to site or finished work quality to insure that they meet the standards of the contract.

- Inspection of workmanship

  Inspects the form of completed structures to see if they meet the supervising standards of workmanship; also confirms work amount completed.

- Issuing of certification

  Issues necessary certificates such for payment to contractors, completion of construction, termination of warranty period, etc.

- Submission of report

  Judges monthly construction reports, drawings-as-completed, and photographs submitted by contractor and in turn submit them to the Indonesian government and JICA. In addition, following the completion of construction, he makes a completion report, which is submitted, to JICA.

4) System of supervision

The system of supervision in this project centers on a staff of local engineers. Two Japanese engineers for Central Sulawesi and North Sulawesi to be involved at the Project site in construction supervision stage and their period of involvement to be determined in consideration of contents of construction and construction period.

2-2-4-5 Procurement Plan

(1) Materials

1) Basic Policy

As Indonesia has experienced a construction boom, both locally produced construction materials and imported materials are readily available.

Therefore, materials needed for this project will basically be procured domestically. In Central Sulawesi, construction materials are customarily procured from Makassaru, and in North Sulawesi from Manado; these will be the base for logistics in this project as well. Imported materials, which are readily available domestically, are to be procured locally.

2) Procurement

a) Cement

Domestically produced cement is mainly Portland cement, and supply meets demand with no problem. For sites in Central Sulawesi, it is available from Makassaru, and for those in North Sulawesi, from Manado.

b) Reinforcing steel

Reinforcing steel produced in Indonesia is equivalent to SD295, and supply meets demand with no problem. For sites in Central Sulawesi, it is available from Makassaru, and for those in North Sulawesi, from Manado.

c) Aggregates/fill material

Since quarrying and production of aggregates in Buol, Central Sulawesi is extremely limited, demand for the project cannot be met locally and aggregates must therefore be shipped over sea from Palu, which is a large producer of aggregates. As for Banggai Kepulauan and North Sulawesi, demand for both aggregates and fill material can be met locally both in terms of quantity and quality.

d) Steel pipe pile, PC steel, steel material for temporary structures

As demand for steel pipe pile, PC steel, and steel material for temporary structures is limited on the island of Sulawesi, there is no availability locally; thus these must be procured and sent over sea from Surabaya where they are produced.

e) Wooden material for molding/stage support

Wooden materials used for temporary structures are produced locally and can be procured near the construction sites. However, plywood for molds are not produced locally and will need to be procured from Makassaru and Manado.

f) Pre-mixed concrete, asphalt mixtures

There are no pre-mixed concrete plants in Central Sulawesi within an hour of any of the sites. There is a pre-mixed concrete plant in Manado, North Sulawesi, which can be utilized in the construction of the Megawati Bridge, but there are none in the vicinity of Poigar Bridge. Therefore, with exception of Megawati Bridge, simple mixing plants will be installed near the bridge sites.

Regarding the availability of asphalt, the situation is the same as with mixed concrete, available for the Megawati Bridge but not for the Poigar Bridge, which will make use of a tempered amount of cold mixture asphalt. Access roads of the bridges in Central Sulawesi are gravel; asphalt is not used.

g) Others

- Mixing water for concrete

  River water around the bridge sites in Buol, Central Sulawesi and Poigar Bridge in North Sulawesi is suitable for mixing concrete. There is an abundant source of water and the sites are away from the river mouth, therefore salt content is not detected. The two bridge sites in Banggai Kepulauan cross seawater; however, use of concrete is small and piped water can be sufficiently procured.

- Shoes, expansion joints

  Items imported from Japan will be used as shoes and expansion joints.

3) Materials procurement plan

In consideration of the above procurement situation, the procurement plan for chief materials is as shown in Table 2-14.

Table 2-14 Sources of Material Procurement

Material	Standard	Buol site	Banggai site	Megawati site	Poigar site
Embankment material		near site	near site	near site	near site
Base material	crusher run	Palu	near site	near site	near site
	crushed stone	〃	〃	〃	〃
Aggregate	crushed stone	〃	〃	〃	〃
Sand		near site	near site	near site	near site
Stone	natural	〃	〃	〃	〃
Bitumen material	Asphalt	———	———	mixtures	near site
Cement	Portland cement	Makssaru	Makassaru	mixtures	Manado
Admixture		Makssaru	Makassaru	Manado	Manado
Reinforcing bar	Deformed bar	〃	〃	〃	〃
PC steel	12.7mm	Surabaya	Surabaya	Surabaya	Surabaya
Sheath	50mm	〃	〃	〃	〃
Mechanical fittings		〃	〃	〃	〃
Steel pipe pile	400mm	〃	〃	———	———
Steel sheet pile	Type III, IV	〃	〃	Surabaya	Surabaya
Steel for temporally structure	H beam etc.	〃	〃	〃	〃
Plywood	for form	Makssaru	Makassaru	Manado	Manado
Timber for temporally structure		near site	near site	near site	near site
Fuel		〃	〃	〃	〃
Rubber bearing		Japan	Japan	Japan	Japan
Expansion joint		〃	〃	〃	〃
Traffic sign board		Makssaru	Makassaru	Manado	Manado

4) Construction machinery

1. Basic policy

As is the case with construction materials, construction machinery is available domestically in Indonesia.

2. Availability of construction machinery

As the result of the boom in construction mentioned above, a large number of large to small scale construction firms are registered throughout Indonesia (4000 in Central Sulawesi alone), each possessing all types of construction machinery according the scale of the company.

Therefore, by having local contractors participate in the project through equipment rental or by subcontracting under conditions of use of company equipment, all machinery used for the project can be procured locally. However, a large-scale hydraulic breaker needed for the removal of existing bridges is presently unavailable domestically and will be needed to be brought in from Japan.

3. Procurement plan for construction machinery

In consideration of the availability of construction machinery as stated above, a procurement plan had been drawn and is shown in Table 2-15.

3) Plan for shipping of materials

1. Shipping routes for domestically procured materials/equipment

A large amount of materials and equipment to be used on site in Central Sulawesi are to be procured from Makassaru and transported over sea.

Since there are no regular shipments between Makassaru and Buol, material and equipment shipments will be chartered. There are two port facilities in Buol, which can both, deal with docking and unloading of 700-ton class cargo ships. Transport from either port to site will be by truck.

As for the two sites in Banggai Kepulauan, there are good port facilities and access by sea poses no problem.

Much of the materials and machinery to be used at sites in North Sulawesi arrive in Manado, and there is no problem in shipping.

PC steel, steel pipe piles and other steel materials, which will be procured from Surabaya, will be shipped to the above mentioned port facilities. There are no particular problems in delivery to site.

Table 2-15 Sources of Machinery Procurement

Machinery	Standard	Buol site	Banggai site	Megawati site	Poigar site
1. Earth work					
Back hoe	0.6m^3	Makssaru	Makassaru	Manado	Manado
Clamshell	0.6m^3	〃	〃	〃	〃
Bulldozer	11t, 15t, 21t	〃	〃	〃	〃
Motor grader	2.7m, 3.8m	〃	〃	〃	〃
Macadam roller	10t ～12t	〃	〃	〃	〃
Dump truck	4t, 8t	〃	〃	〃	〃
Water cart	5t	〃	〃	〃	〃
Asphalt finisher					
2. Remove existing bridge					
Hydraulic breaker	600kg	―――	―――	Japan	Japan
Concrete breaker	20kg	Makssaru	Makassaru	Manado	Manado
3. Concrete work					
Wheel loader	1.2m3	Makssaru	Makassaru	Manado	Manado
Concrete mixer	tilting mixer 0.5m^3	〃	〃	〃	〃
Pot mixer	350L	〃	〃	〃	〃
Agitator car		〃	〃	〃	〃
Concrete vibrater		〃	〃	〃	〃
Concrete hopper		〃	〃	〃	〃
Crane	15t	〃	〃	〃	〃
4. Transportation					
Track crane	3t	Makssaru	Makassaru	Manado	Manado
Track	8t	〃	〃	〃	〃
Triler track	32t	〃	〃	〃	〃
Fork lift	1t	〃	〃	〃	〃
5. Errection work of PC girder					
Transportation cart		Surabaya	Surabaya	―――	―――
Rail for cart		〃	〃	―――	―――
Side loading jack		Makssaru	Makassaru	―――	―――
6. Fablication work of PC girder					
Grout pump		Makssaru	Makassaru	Manado	―――
Grout mixer		〃	〃	〃	―――
Tensioning jack		〃	〃	〃	―――
7. Dewatering work					
Submerged pump (by electricity)	3", 4"	Makssaru	Makassaru	Manado	Manado
Submerged pump (by engine)	2", 3"	〃	〃	〃	〃
8. Pile driver					
Diesel pile hammer	2.5t crawler	Makssaru	Makassaru	―――	―――
Reverse circulation drill	S1500	―――	―――	Manado	―――
9. Temporally bridge, cofferdam					
Vibro hammer	40w, 60w	Makssaru	Makassaru	Manado	Manado
10. Replacement of temporally bridge					
Crawler crane	50t	―――	―――	―――	Manado
11. Ordinal					
Track crane	20t, 25t, 40t	Makssaru	Makassaru	Manado	Manado
Genelator	50, 100, 200KVA	〃	〃	〃	〃
Compressor	3.5m3 ～15m^3	〃	〃	〃	〃
Welder	200A, 300A	〃	〃	〃	〃
Bar cutter, Bar bender		〃	〃	〃	〃
12. Vehicle					
Twin cab track	1 ～2t	Makssaru	Makassaru	Manado	Manado
Station wagon		〃	〃	〃	〃
Pick up track	2t	〃	〃	〃	〃
Track	6t	〃	〃	〃	〃

2-2-4-6 Quality Control Plan

To implement this Project will be applicable the technical standard by Indonesian Standard, Ministry of Land and Transport in Japan and Japan Highway Public Cooperation.

2-2-4-7 Implementation Schedule

(1) Steel Girder Procurement Type

Implementation schedule of Steel Girder Procurement Type for Central Sulawesi is shown on Figure 2-10.

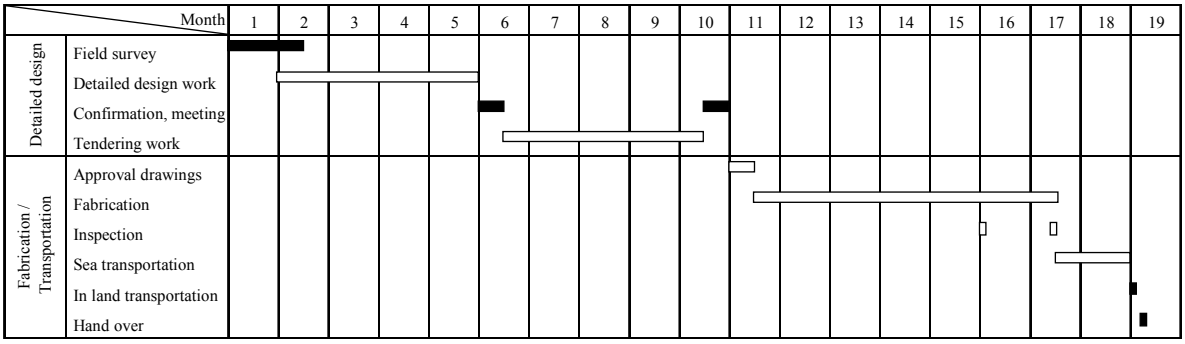


Figure 2-10 Implementation Schedule of Steel Girder Procurement Type for Central Sulawesi

(2) Bridge Construction Type

Implementation schedule of Bridge Construction Type for Central Sulawesi is shown on Figure 2-11.

Implementation schedule of Bridge Construction Type for North Sulawesi is shown on Figure 2-11.

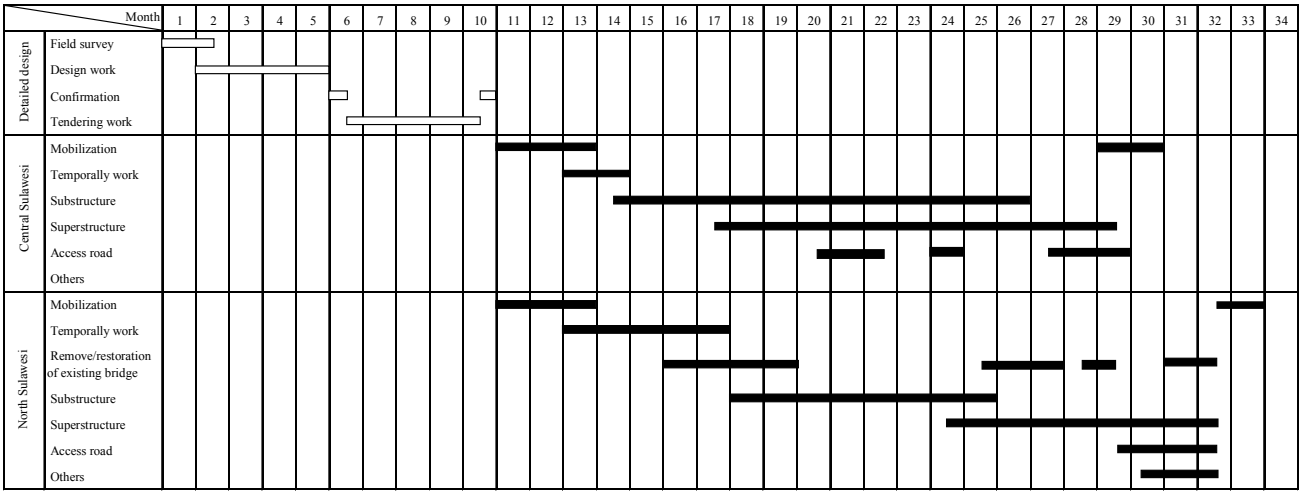


Figure 2-11 Implementation Schedule of Bridge Construction Type for Central Sulawesi

2-3 Obligations of Recipient Country

(1) Steel Girder Procurement Type (Component A)

The following items are the obligation of the recipient country in the case of Steel Girder Procurement Type:

1. General

1.1 Bank Arrangement.

1.2 Authorization to Pay: Advising Commission of A/P and Payment Commission.

2. Implementation

2.1 To secure land for bridges, connecting roads, temporary offices, and storage yard and take responsibility for demolition of all obstacles, if necessary.

2.2 To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

2.3 To secure buildings prior to the procurement in case the installation of the equipment.

2.4 Tax exemption and customs clearance of the products at the port of disembarkation.

2.5 To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of products and services under the Verified Contracts.

2.6 To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under Verified Contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

2.7 To clear, level and reclaim the sit before commencement of the construction when needed.

2.8 To construct gates and fence in and around the site when needed.

2.9 To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid.

2.10 To bear all the expense, other than those to be borne by Grant Aid, necessary for construction of facilities.

2.11 Accessibility to the construction site: The Indonesian side shall maintain sound accessibility to the construction site during the construction stage.

3. Others

3.1 Budget preparation for Land acquisition and compensation, Consultants services, Civil

works, Utility relocation and others (Local portion).

3.2 Implementation for Land acquisition and compensation.

3.3 Consultants Contract for D/D and C/S (Local potion).

3.4 Consultants Contract for D/D (Grant Aid potion).

3.5 Civil Works Contract (Local potion).

3.6 Procurement Contract (Grant Aid potion).

3.7 Preparation of Stockyard for Steel Girders.

3.8 Utility Relocation.

(2) Bridge Construction Type (Type Component B)

The following items are the obligation of the recipient country in the case of Bridge Construction Type:

1. General

1.1 Bank Arrangement.

1.2 Authorization to Pay: Advising Commission of A/P and Payment Commission.

2. Implementation

2.1 To secure land for bridges, connecting roads, temporary offices, and storage yard and take responsibility for demolition of all obstacles, if necessary.

2.2 To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

2.3 To secure buildings prior to the procurement in case the installation of the equipment.

2.4 Tax exemption and customs clearance of the products at the port of disembarkation.

2.5 To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of products and services under the Verified Contracts.

2.6 To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under Verified Contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

2.7 To clear, level and reclaim the sit before commencement of the construction when needed.

2.8 To construct gates and fence in and around the site when needed.

2.9 To maintain and use properly and effectively the facilities constructed and equipment

provided under the Grant Aid.

2.10 To bear all the expense, other than those to be borne by Grant Aid, necessary for construction of facilities.

2.11 Accessibility to the construction site: The Indonesian side shall maintain sound accessibility to the construction site during the construction stage.

3. Others

3.1 Budget preparation for Land acquisition and compensation, Utility relocation and others.

3.2 Implementation for Land acquisition and compensation.

3.3 Consultants Contract for D/D and C/S.

3.4 Civil Works Contract.

3.5 Utility Relocation.

2-4 Project Operation Plan

(1) Operation/Maintenance System

Following the construction of the bridges, proper operation and management are extremely important in order to maintain the functions of the bridges and access roads.

If the maintenance described below is adhered to, the bridges will not require major repairs or reinforcement for 20 to 30 years after completion.

Furthermore, weather proofing steel used in the material/equipment supply cooperation project will not require painting or coating in the future.

Regarding the maintenance system of the bridges, a new system will not be established but rather the existing one; for road management will be used to administer them.

(2) Maintenance

1) Routine inspection, Maintenance work, Repair work

This project is centered on bridges but also includes the maintenance of access roads and revetment. Maintenance work of the bridges will be carried out according to the contents of Table 2-16.

Table 2-16 Types of Maintenance Work

Facility		Inspection items and contents of maintenance	Frequency of inspection
Bridges	Drainage pipes	Removal of sand, leaves, etc. clogging pipes	Every 6 months & before rainy season
	Expansion joints	Sand removal, adjustment of loose joints, replacement of lost or damaged rubber	Every 6 months
	Guardrail	Repair of damage by accidents	When necessary
	Bearings	Removal of excess sediments and vegetation	Every 6 months
	Substructure	Removal of wood caught around substructure and weeds	When necessary
		Inspection for scouring and adding gabions and stones	Yearly
Roads	Gravel-paved surfaces	Correction of ruts, replacement of gravel	Every 6 months
	Asphalt-paved surfaces	Inspection for unevenness, cracks, etc	Yearly
	Road shoulders and banks	Repair of bank protection	Every 6 months
Revetment		Inspection, repair, and adding of gabions	Every 6 months

2) Maintenance System

Early discovery of damage and prompt repair works keep the content of repair light, thus contributing to reduction of repair costs and to longer structure life.

It is therefore necessary to carry out periodical inspections and maintenance works according to a plan, as shown in Table 2-16.

The maintenance team for periodical inspections should consist of one (1) engineer and about four (4) workers making rounds in a twin-cab truck loaded with necessary tools and parts for replacing (basic tools such as shovels, screwdrivers, pliers; guardrail parts, etc. for replacing).

Upon discovery of damage or a problem, a record of it is made and repairs and/or removal of dirt, etc. are conducted. Repairs that are beyond the capabilities of the maintenance team will be referred to specialists who will be commissioned to handle the repairs.

Records of inspection results will be carefully kept as important data useful in hypothesizing schedules and extent of repair work in the future.

3) Time required for work

From among the items of periodical inspection and maintenance work shown in Table 2-16, the tasks of the maintenance team will include cleaning of deck drainage pipes, cleaning and basic adjustment of expansion joints, cleaning of bearings, maintenance of substructure

(scour check, removal of objects), correction of ruts, and adding of gravel in access roads, inspection of revetment. The typical required time for the work is shown below.

Advanced repair of expansion joints, countermeasures for scouring (additional placement of stones, etc.), and guardrail repair work will be referred to specialists.

Base to site		0.5 hrs × 2 (round trip)
Inspection		1.0 hr.
Work	Drainage pipe cleaning	1.0 hr.
	Cleaning of bearings area	0.5 × 4 points
	Cleaning of pier area	1.0 hr.
	Cleaning of expansion joints	0.5 hrs × 2
Total time required for inspection/maintenance works of one bridge :		7.0 hrs

(3) Project Operation and Maintenance Cost by Indonesian Side

1) Project Operation Cost

i) Steel Girder Procurement Type (Component A)

Indonesian side will be required the following project budget to implement the Project for Central Sulawesi in Kabupaten Buol (refer to Table 2-17).

Table 2-17 Required Project Budget for Steel Girder Procurement Type

No.	Name of Bridge	Length (m)	Construction Cost (1,000Rp.)			Remarks
			Bridge	Approach Road	Total	
A. Construction Cost						
1.	General		181,926	87,116	269,042	7% of Total 2.
2.	Direct Construction Cost					
B7	KOKOBUKA II	10	311,582	186,446	498,028	2 abutments (direct foundation)
B8	KOKOBUKA III	20	516,829	191,757	708,586	2 abutments (pile foundation)
B10	KOKOBUKA V	15	246,865	99,856	346,721	2 abutments (direct foundation)
B17	TAYADUN II	20	510,309	300,106	810,415	2 abutments (pile foundation)
B18	TAYADUN III	20	478,295	125,645	603,940	2 abutments (pile foundation)
B19	BONOBOGU I	20	535,063	340,704	875,767	2 abutments (pile foundation)
	Total of 2.	105	2,598,943	1,244,514	3,843,457	
3.	Sub-Total		2,780,869	1,331,630	4,112,499	1. + 2.
4.	V.A.T		278,087	133,163	411,250	10% of 3.
Total of A.			3,058,956	1,464,793	4,523,749	3. + 4.
B. Land Acquisition and Compensation Cost					162,642	for 14 Bridges
C. Consultants Fee		Detailed Design & Supervision			316,662	7% of Total A.
D. Grand Total					5,003,053	A. + B. + C.

ii) Bridge Constriction Type (Component B)

Indonesian side will be required 150 million Rupiah as the relocation cost of water pipe line beside of the Megawati Bridge line in order to implement the Project for North Sulawesi Constriction Type by Japan.

2) Maintenance Cost

The maintenance after the completion of this Project will be carried out the Government of Central Sulawesi and North Sulawesi Province. The estimated cost for maintenance cost is described as follows:

i) Periodic inspection work cost

The periodic inspection, miner repair/maintenance is entrusted to a local construction company and the estimate for a period of one (1) year is shown below:

Personal expenses		
Engineer	1 person	Rp. 300,000
Common Labor	4 person	Rp. 200,000
Miscellaneous	50% of above total	Rp. 250,000
Equipment (Vehicle etc.)	1 vehicle	Rp. 200,000
Overhead & Profit	20% of above total	Rp. 190,000
Total	Per 1 Bridge	Rp. 1,140, 000

The estimated periodic inspection cost in Central Sulawesi is as follows:

14 Bridges × 1,140,000 Rp./Bridge × 2 times/year=31, 920,000 Rp./year

The estimated periodic inspection cost in North Sulawesi is as follows:

2 Bridges × 1,140,000 Rp./Bridge × 2 times/year=4,560,000 Rp./year

ii) Scour prevention maintenance work cost

It is assumed that 25 % of volume of riprap work around constructed piers is scoured per year. Scour prevention maintenance work will supply scoured riprap.

The estimated periodic inspection cost in Central Sulawesi is as flows:

6 piers × 60 m^3/pier × 25% × 66,570 Rp./m^3=5,991,300 Rp./year

The estimated periodic inspection cost in North Sulawesi is as flows:

6 piers × 100 m^3/pier × 25% × 66,570 Rp./m^3=9,985,500 Rp./year

iii) Asphalt pavement repair work cost

The asphalt pavement repair work is entrusted to a local construction company and the estimate for a period of ten (10) years is shown below:

1990m^2 × 51,000 Rp./m^2=101,490,000 Rp./10 years

The summary of maintenance cost is shown on Table 2-18.

Table 2-18 Summary of Maintenance Cost

Description	Central Sulawesi	North Sulawesi	Remarks
Periodic inspection work cost	31, 920,000 Rp./year	4,560,000 Rp./year	2 times/year
Scour prevention maintenance work cost	5,991,300 Rp./year	9,985,500 Rp./year	1 time/yea
Annual Maintenance Cost	37,911,300 Rp./year	14,545,500 Rp./year	Per year
Asphalt pavement repair work cost	N/A	101,490,000 Rp./10 years	1 time/10years

CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATIONS

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

Favourable effects resulting from the implementation of the project are summarized as follows:

(1) Direct Effects

1) Central Sulawesi

1. More consistent and safety transportation availability

   Year-round transportation will be made available, daily life of local inhabitants will be improved (force to wade or use small boats to cross the rivers, transportation of agriculture products and fertilizer, alleviation of detour routs to schools and hospitals).

2. Increase of Traffic Load for Heavy Vehicle (5 ton to 20 ton)

   Traffic load limit increase to 20 ton, heavy loaded road network within Kabupaten will be formed.

3. Deduction of Transportation Time

   Rehabilitation of torn road network, for example, transportation time from Kokobuka area to Buol Port will be deducted 30 minutes from 2 hours 15 minutes to 1 hour 45 minutes (driving speed suppose to 20 km/h).

2) North Sulawesi

The 5-ton limit now in effect on the bridges in alleviated and restoring the intended function of the Trans-Sulawesi Highway.

(2) Indirect Effects

1. Agricultural activity

   With smoother traffic made possible along the road network, agricultural products are more easily and quickly shipped and the use of fertilizers becomes more practical, therefore vitalizing the agricultural industry.

2. Improved standard of living

   With improved access to marketplaces, the shipment of daily necessities is facilitated and standard of living is improved.

3. Regional effects

   The construction of bridges whose absence caused traffic stoppages will not only have a favourable direct effect on local residents, but will also have an immense ameliorating effect on the transportation infrastructure, thereby promoting the longer term effects of economic and industrial development in surrounding regions as well as the project region itself.

4. National effects

   This project supports the PROPENAS: 1999-2004

3-2 Recommendations

The earliest possible realization of this project will be extremely effective in the development of the region's entire road network and contribute to the economic and social development of local as well as regional inhabitants.

As for the six (6) bridges in the procurement category for which the Indonesia government must bear expenses, the regional development budget, has appropriated funds, so there is no problem in that regard. Note: The regional development budget is under the auspices of BAPPENAS (Badan Perencanaan Pembangunan Daerah: National Development Planning Agency).

Furthermore, regarding the operation and management of the project, the Ministry of Settlement and Regional Infrastructure (the implementing agency of this project) has exchanged agreements with the respective Provincial Governments, who will undertake maintenance. Therefore it is deemed that maintenance establishment is also sufficiently in order.

However, following the administration of the project, if maintenance is not properly carried out, it will be impossible to carry on the project's function in the long term. Especially during the rainy season, it is necessary to keep access roads, revetment and riverbed works under surveillance and make repairs for the smallest damage immediately. The Indonesian government must provide these expenses.