

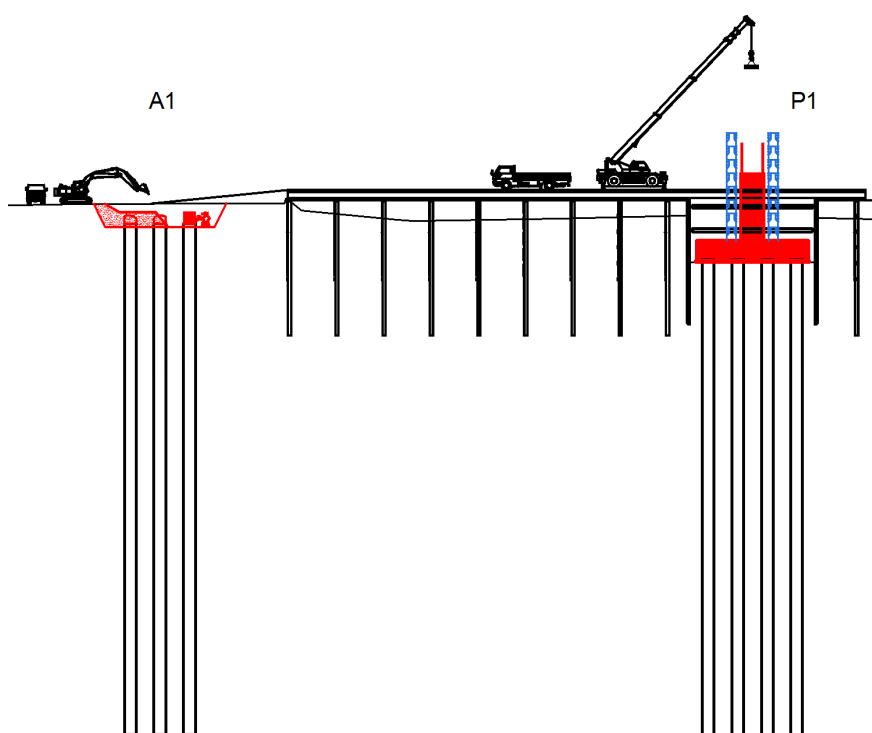
2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Palu 4 Bridge is located in the river mouth area of the Palu River strongly affected by the tide level, and the project involves over-water work with the tidal range of approximately 2.8 m (water depth from 0.5 m to 3.3 m). The following describes the implementation policy for the bridge construction.

(1) Substructure

Because abutment construction will be performed on land, it will be general structure construction using self-standing cofferdam work or unsupported excavation. Pier construction will be performed on water, and the pile foundation and main frame construction works will be performed on temporary jetties. It should be noted that the cofferdam work for piers will be performed underwater, and it is necessary to take into consideration the impact of the water level with the daily tidal range of 2.8 m.

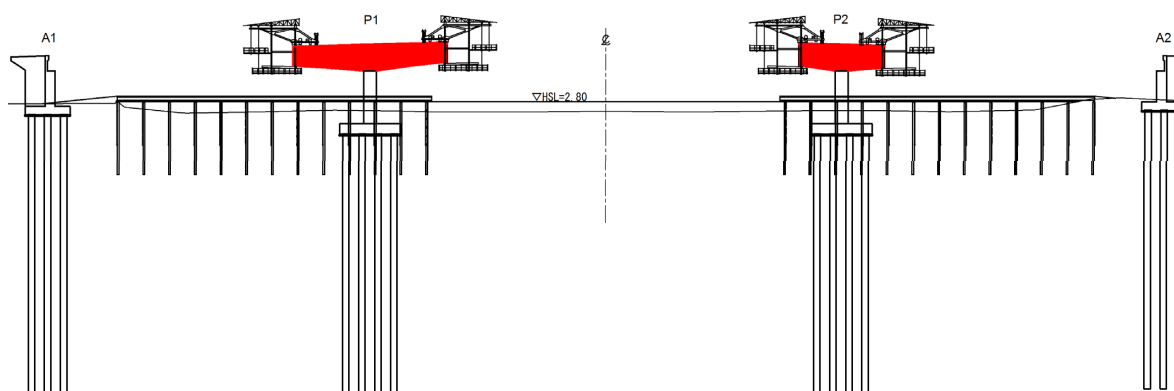


Source: JICA Study Team

Figure 2-2-21 Construction for Substructure

(2) Superstructure

Because the work on bridge superstructure will be performed over the water, supporting work involving the construction of gantries will be uneconomical and will require long work period, and the use of cantilevered construction making use of P1 and P2 piers will be advantageous. The supply of materials will be provided using a temporary jetty.



Source: JICA Study Team

Figure 2-2-22 Construction for Superstructure

2-2-4-2 Implementation Considerations

(1) Construction Period

Because the Government of Indonesia requests for early completion of work, it is necessary to perform work both from the right bank and the left bank simultaneously. The period of work is assumed to be 20 months at the present, as shown in Figure 2-2-23. However, because geological explorations have not been completed at the time of this assumption, it may change in the detailed design.

Item	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Preparatory Work & Temporary Bridge	4.0																				
Foundation Pile & Substructure	6.0																				
Superstructure	8.0																				
Surface Work & Clearance Work	4.0																				

Source: JICA Study Team

Figure 2-2-23 Construction Period

(2) Construction on the water

It is necessary to keep in mind that the coffering work for pier construction is performed in the river mouth area of the Palu River, and the water depth changes between 0.5 m and 3.3 m.

(3) Approach Road

The approach road areas will have the banking height of 0-11 m, and they are expected to have relatively soft soil. The measures against subsidence of foundation structures and other necessary measures will be considered after the completion of geological explorations.

(4) Characteristic of Construction Site

The construction site is on Sulawesi Island, and large special construction machines must be procured from Java Island or a third country. Attention must be paid to the influence of transportation on work period. In addition, while general workers can be recruited from Sulawesi Island, special skilled workers must be procured from Java Island or a third country.

2-2-4-3 Scope of Works

When this project is conducted through Japanese grant aid, the division of responsibilities between Japan and Indonesia concerning construction work shall be as follows.

(1) Implementation by Japan

- Transportation of materials and equipment from Japan or a third country to the port of discharge
- Land transport from the port of discharge in Indonesia or the source of materials and equipment to the site
- Construction of slope collapse countermeasures and road restoration work indicated in the design drawings
- Construction and removal of work bases, work yards, and camps associated with the construction work
- Procurement of materials, equipment, and workforce needed for the construction work
- Work management services needed for the construction work
- Consultant services needed for the implementation of the project

(2) Implementation by Indonesia

- Acquisition of and compensation for the land needed for the implementation of this project, the procedures for relocation of public facilities and obstacles within the site, and the work for relocation.
- Coordination with relevant authorities and obtaining permissions and authorization concerning the installation of facilities. In particular, agreement with DHR.
- A/P notification and fee payment to the Japanese bank according to Banking Arrangements
- Exemption from customs duties and exemption from customs clearance fees concerning the products landed at the port

- Exempting Japanese persons from the payment of customs duties, domestic taxes, and value-added tax on the products and services procured within the framework of the certification contract
- Relocation of electric power, water supply, drainage, and other facilities to the vicinity of the site. Coordination with relevant authorities and obtaining permission and authorization concerning installation, supply of electricity to lighting and signalling facilities, etc.
- Road maintenance in the maintenance segments other than the segments to be improved by the Japanese side
- As necessary, improvement work on existing roads after the completion of the construction work conducted by the Japanese side
- Appropriate use and maintenance of the facilities constructed through this grant aid cooperation
- Paying the expenses needed for the construction of facilities other than the expenses covered by this grant aid cooperation

2-2-4-4 Consultant Supervision

For the implementation of this project, the first steps are the Exchange of Notes (E/N) between the Governments of Japan and Indonesia and the conclusion of the Grant Agreement (G/A) between JICA and the Government of Indonesia. After the conclusion of the above, the consultant and the Ministry of Public Works and Housing (hereinafter referred to as PU), which is the implementing agency on the Indonesian side, enter into the consultant service agreement regarding the implementation design, tender assistance services, and construction supervision based on the letter of recommendation issued by JICA. The matters contained in the consultant agreement are as follows.

(1) Preparation of Bidding Documents

To prepare bidding contract documents based on the results of the present study report and obtain the approval of PU. The bidding contract includes the following matters.

- Design drawings and quantities
- Bidding instructions, construction contract (draft), and technical specifications

(2) Tender Assistance

The consultant assists PU in conducting the bid for the construction work. The tender assistance service includes the following matters.

- Bid announcement
- Prequalification examination
- Bid evaluation
- Contract negotiation

(3) Construction Supervision

Following the JICA's approval of the construction contract, the consultant issues the notice to proceed to the constructor and begins construction supervision services. In the construction supervision services, the consultant provides reports on the progress of construction directly to PU, Japanese embassy in the country, etc. For the constructor, the consultant performs the official activities concerning the progress of work, product quality, safety, and payments, and makes proposals for technical improvement of work.

In addition, the consultant conducts coordination and consultation with JICA, the Japanese embassy in the country, and the Government of Indonesia as necessary. The main contents of services are as shown in Table 2-2-18.

Table 2-2-18 Construction Supervision Plan

Division	Contents of Service
① Approval of work execution plan and working drawings	To verify that the work execution plan, construction schedule, and working drawings conform to the contract, contract drawings, specifications, etc. and give approval.
② Process supervision	To receive the report of work progress from the constructor and give orders necessary to ensure the timely completion of construction.
③ Quality supervision	To inspect the conformity of construction materials and work execution to contract drawings and specifications and give approval.
④ Output supervision	To inspect as-built cross-sections, planar shapes, etc. to verify that the as-built products conform to the supervision standard and also to confirm quantities.
⑤ Issuance of certificates	To necessary certificates regarding the constructor payment, completion of work, end of warranty period, etc.
⑥ Submission of reports	To inspect the monthly work reports, as-built drawings, as-built photographs, etc. prepared by the constructor and submit them to the Government of Indonesia and JICA. In addition, to produce the report of completion submit it to JICA after the completion of construction.

Source: JICA Study Team

2-2-4-5 Quality Control Plan

Quality control shall be conducted based on the specifications developed in the project. The specifications shall be in accordance to AASHTO or the Japanese standards and test methods. The quality control plan (draft) is shown in Table 2-2-19, and the as-built management plan (draft) is shown in Table 2-2-20.

Table 2-2-19 Quality Control Plan

Work	Objective	Inspection, Test for Supervision , etc.	Frequency of Inspection and Test
Earthwork, asphalt pavement work, roadbed, subgrade, filling of structures	Materials management	CBR test, soil quality test (specific gravity, grain size, moisture content, liquidity & plastic limit, density), lubricant test (specific gravity, grain size, strength, water absorption), bituminous materials (quality certificate, component analysis table)	Before work
	Routine management	Compaction density test, moisture content, bituminous materials (stability, flow value, percentage of voids, Marshall test, temperature)	Shortly after work Once daily for each layer in each work area
Concrete work	Batcher plant	Weighing equipment: mixing performance, static load test; batching control board: dynamic load test, mixing performance	Before work, monthly (every 3 months for loading tests)
	Materials	Cement, water: tests using standard conformity certificates. Fine aggregate & coarse aggregate tests, grading, specific gravity, water absorption, unit weight, durability, alkali-aggregate reaction	Before work and when a different material is used
	Concrete standard tests	Test mixing to determine composition. Slump, air content, temperature, test piece strength	Before work
	Routine management	Fresh concrete: air content, slump, temperature	First 5 consecutive units and thereafter at 50 m ³ intervals, and when test pieces are made
		Placement of concrete: placement method, compacting, position of construction joint, curing method, treatment of laitance	Witness inspection at the time of placement
		Concrete test piece: test for compressive strength of test piece. Preparation of concrete control chart	Test pieces are made once daily; 7 days and 28 days after placement
Rebar and prestressing steel	Materials	Rebar and prestressing steel are confirmed by mill sheets from the manufacturers. Quality, tensile strength, bending tests	Before work
	Installation inspection & routine management	Tests are conducted on the built assembly in terms of: material size, dimensions, allocation, lap length, cover, condition of fixation, treatment of construction joint	Before concrete work: 100% inspection for each segment of concrete placement
Tensioning of prestressing steel	Confirmation of concrete strength	<ul style="list-style-type: none"> Compressive strength of concrete test piece 	Before tensioning
	Tensioning device	<ul style="list-style-type: none"> Calibration of jacks and pumps 	Before tensioning. For every 50 cables tensioned and when the combination of tensioning devices is changed
	Test tensioning	<ul style="list-style-type: none"> According to tension control chart 	Before final tensioning
	Tension control	<ul style="list-style-type: none"> Control of individual cables Control of groups of cables Control of transverse prestressing steel 	At the time of tensioning Tension control chart
PC grout	Mix design	Consistency, bleeding rate, expansion rate, strength, total salt	Before use
	Routine management	Consistency, temperature	Once daily, for every 5 batches
		Bleeding rate, expansion rate, compressive strength	Once daily

Source: JICA Study Team

Table 2-2-20 As-Built Management Plan

Work	Process	Item	Standard Value	Remarks
Earthwork	Roadbed	Planned height	5cm	At 40m intervals
		Width	-10cm or more	"
	Base course	Planned height	±4cm(±2.5cm) or more	"
		Finished thickness	-4.5cm(-2.5cm) or more	"
		Width	-5cm or more	"
Pavement	Asphalt pavement	Width	±4cm or more	"
		Thickness	-1.5cm or more	" Mean of 10 data
Foundation work	Crusher-run unscreened gravel, crushed stone, rubble, leveling concrete	Width	Design value or more	
		Thickness	-30mm	
		Elongation	Depends on each structure	
	H section steel, steel pile	Standard height	±50mm	
		Embedment length	Design value or more	
		Eccentricity	Within D/4 and within 100mm	
		Inclination	Within 1/100	
Rebar work	Assembly	Average interval	±Φ	Φ: rebar diameter
		Cover	±Φ and no less than the minimal required cover	Φ: rebar diameter
Concrete structure (retaining wall work)		Standard height	±50mm	For each 40m/1 place
		Thickness	-20mm	For each 40m/1 place
		Width	-30mm	For each 40m/1 place
		Height	-50mm	For each 40m/1 place
		Elongation	-200mm	40m/1 work area

Source: JICA Study Team

2-2-4-6 Procurement Plan

(1) Construction Materials

While prestressing cables will be imported from Japan or a third country, other construction materials such as concrete and asphalt materials can be procured in Indonesia. Table 2-2-21 lists the sources of main materials procured.

Table 2-2-21 Procurement List of Materials

Construction Material	Local Procurement	From Japan	From Third Country	Remarks
Steel	○			
Prestressing steel	○	○		
Rebar (D13~D32)	○			
Rebar (D36~D50)	△	○		Custom-made locally
H section steel	○			
Cement	○			
Asphalt concrete	○			
Ready-mixed concrete	○			
Crushed stone & sand	○			
Form materials	○			
Steel form	○			
Timbering & scaffolding materials	○			
Hume pipe	○			

Source: JICA Study Team

1) Concrete

Concrete can be supplied from the ready-mixed concrete factory “PT.UTAMA BETON,” which is located approximately 50 km northeast of the mouth of the Palu River.

2) Bitumen and Asphalt

In the vicinities of Palu City, asphalt mixtures for pavement work can be supplied without problems from “PT.Asbuton Jaya Abadi.”

3) Steel Materials

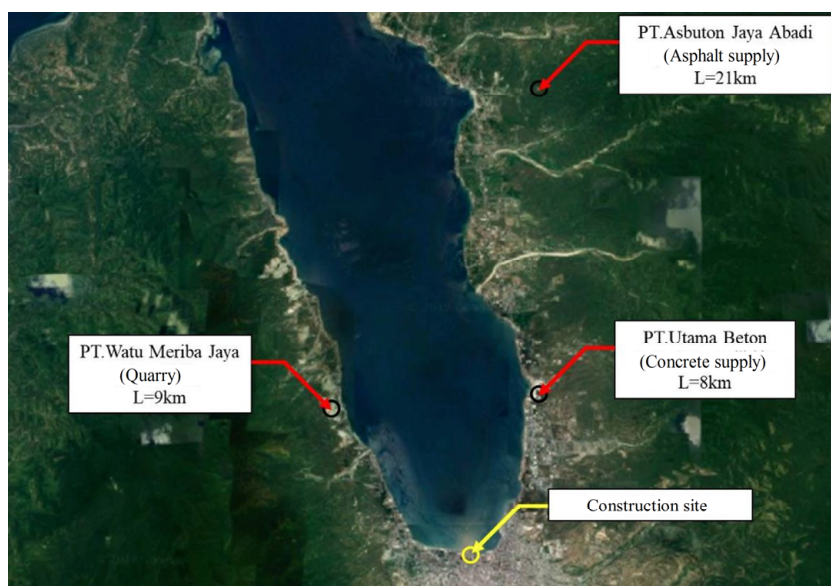
H section steel and other types of steel materials will be procured mainly from Jakarta. There is no problem in supply.

4) Aggregate

There are several quarries, such as “PT.Watu Merida Jaya” located 15 km northwest of the mouth of the Palu River. There is no problem in the supply of aggregates.

5) Location of Procurement

The location of procurement is shown in Figure 2-2-24.



Source: JICA Study Team

Figure 2-2-24 Location of Procurement

(2) Construction Machines

The general-purpose machines used in this project will be procured from Indonesia as a rule. Table 2-2-22 lists the sources of main equipment procured.

Table 2-2-22 Procurement List of Machines

Construction Machine	Local Procurement	From Japan	From Third Country	Remarks
Dump truck	○			
Backhoe	○			
Bulldozer	○			
Truck crane	○			
Asphalt finisher	○			
Tire roller	○			
Vibration roller	○			
Large breaker	○			
Engine-generator	○			
Crawler crane	○			
Pile driver (reverse method $\phi 1,500\text{mm}$)		○		
Vibro hammer	○			

Source: JICA Study Team

(3) Labour Service

1) Outline

Subcontractors are expected to be Indonesian construction companies with offices in Jakarta. It is considered that the workforce needed for this project can be procured in Indonesia through subcontractors.

The statute concerning wages includes the revised Labour Law, as well as the Ordinance of the Minister for Labour Standards defining overtime work and overtime wages and “the Government Regulation No. 78 of 2015 on Wages” stipulating the percentage of increase in minimum wages.

The statute concerning employment conditions states that main work conditions must be defined in employment contracts according to the Labour Law. Main work conditions include wages, working hours, holidays, rest breaks, retirement payments, bonuses, etc.

2) Civil Engineers

According to the survey conducted in August 2018 by Statistics Indonesia, there are 131 million persons in the worker population in Indonesia (including approximately 7 million unemployed). Approximately 8.7 million persons (6.69% of the working population) are engaging in the construction industry. Of these workers, approximately 1 million persons are in regular employment. On the other hand, there are approximately 150,000 construction companies in Indonesia. Because there are approximately 8.7 million construction workers and 150,000 construction companies in Indonesia, it is considered it is possible to secure a sufficient workforce. While there are plenty of workers, the ratio of graduates from colleges or higher schools in the working population is low at 4.29% in the sum of men and women, and a problem may be pointed out that the human resources with specialized basic knowledge and skills are limited.

3) Labourers from Third Country

The employment of workers from a third country is stipulated in the Labour Law, Chapter VII, Articles from 42 to 49. Workers from a third country must obtain permission of the Ministry of Labour and other authorities to be employed in Indonesia. Furthermore, employment of them is limited to specific positions and periods, the relevant foreigners are required to satisfy rules on job positions and competence standards. Workers from a third country are allowed to be employed only in managerial and professional positions that cannot be filled by workers in Indonesia.

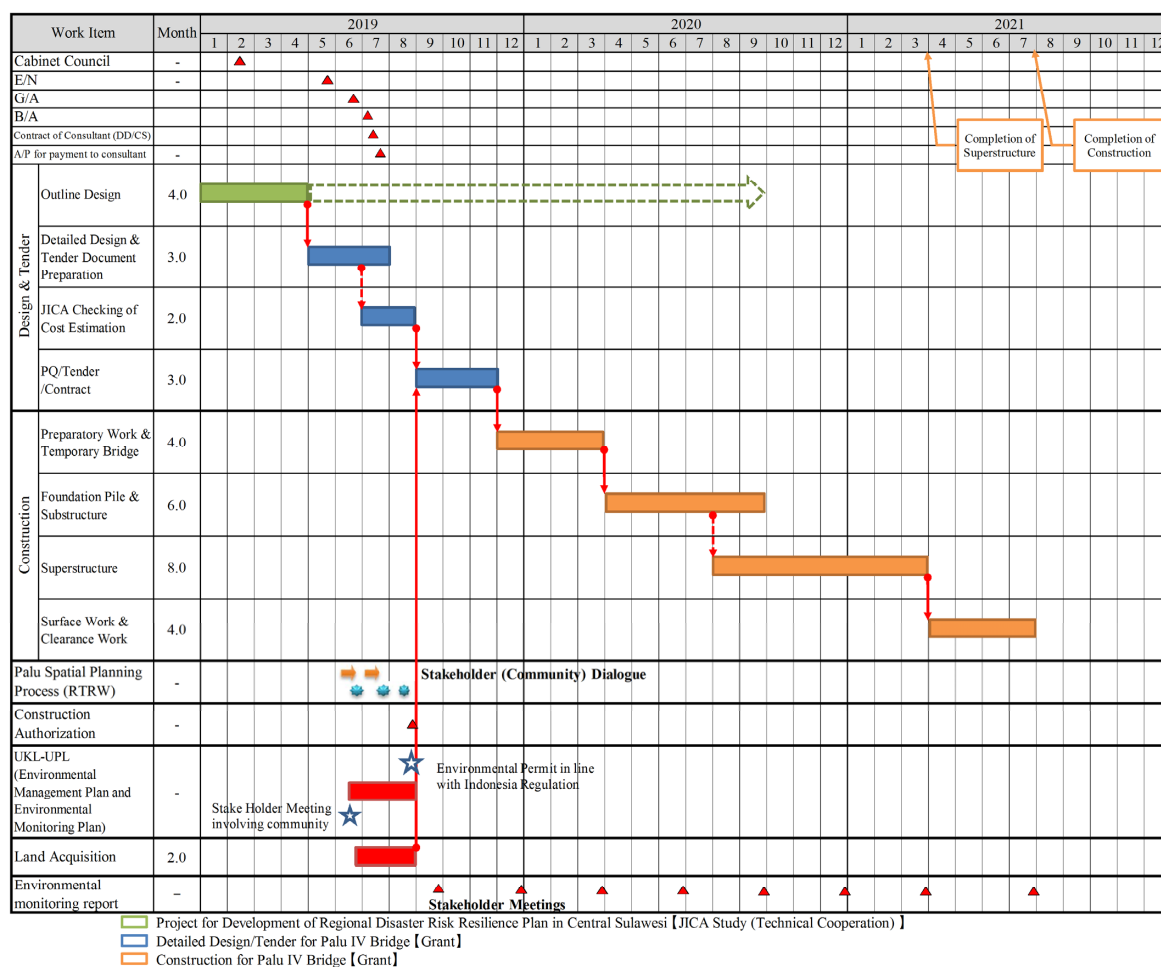
2-2-4-7 Implementation Schedule

Table 2-2-23 shows the implementation schedule (draft) based on the results of this study. After the completion of this study, the project will proceed with implementation design services, including detailed design and preparation of bidding documents, and then construction supervision services, including tender and construction.

The implementation design begins with the field survey, which is followed by work in Japan, including detailed design and the preparation of specifications and bidding documents. Subsequently, explanation is given to the Indonesian side concerning the detailed design. Construction supervision services that follow include tender assistance and the work related to constructor contract, This process will take 7 months.

On the other hand, construction work takes approximately 20 months in total. Bridge substructure work, bridge superstructure work, road civil engineering work, pavement work, etc. are executed in this period.

Table 2-2-23 Implementation Schedule (Tentative)



Source: JICA Study Team

2-3 Obligation of Recipient Country

The obligations of the Indonesian side in this project shall be as follows.

(1) General Matters

- Banking arrangements
- Authorization to Pay (A/P) notification and payment of fees

(2) Project Implementation

- Acquisition of land for construction, leasing of land for temporary work, compensation for relocation of properties, and removal/relocation of obstacles
- Coordination with relevant authorities and obtaining permissions and authorization concerning the installation of facilities
- Exemption of imported products from customs duties and exemption from customs clearance fees
- To provide Japanese personnel with necessary convenience concerning the transport of products

and services into the country arranged within the framework of the certification contract

- To exempt Japanese personnel from the payment of customs duties, domestic taxes, and value-added tax on the products and services procured within the framework of the certification contract
- Coordination with relevant authorities and obtaining permissions and authorization concerning relocation/installation of electric power, water supply, drainage, and other ancillary facilities (including the supply of electricity to lighting facilities) to the vicinity of the site
- Road maintenance in the maintenance segments other than the segments to be improved by the Japanese side
- As necessary, improvement work on existing roads after the completion of the construction work conducted by the Japanese side
- Appropriate use and maintenance of the facilities constructed through this grant aid cooperation
- Paying the expenses needed for the construction of facilities other than the expenses covered by this grant aid cooperation

(3) Other

- Tender method and contract method according to the grant aid cooperation guidelines of Japan
- Contract with the Japanese consultant that performs implementation design and construction supervision
- Construction contract with the Japanese constructor

2-4 Project Operation Plan

2-4-1 Operation and Maintenance System

Bridge maintenance is extremely important for the prolonged stable operation of the Balu 4 Bridge. The maintenance of this bridge will be conducted by Bina Marga under PU. See Figure 1-1-1 and Figure 1-1-2 for organization charts.

2-4-2 Operation and Maintenance Methods

For bridge maintenance, the diagnosis of integrity will be conducted at 5-year intervals as follows. Based on the results of integrity diagnosis of members, necessary measures will be taken to ensure the efficient maintenance and repair of the bridge.

a) Integrity Evaluation Criteria

Division		Condition
I	Healthy	A condition causing no problem in the function of the structure.
II	Preventive maintenance stage	There is no problem in the function of the structure, but an action is desirable from the viewpoint of preventive maintenance.
III	Early action stage	There is a possibility of a problem in the function of the structure, and an action should be taken early.
IV	Emergency action stage	A problem has occurred, or very likely to occur, in the function of the structure, and an action should be taken immediately.

b) Integrity Evaluation Units

Superstructure			Substructure	Bearings	Other
Main girder	Cross beam	Floor slab			

c) Types of Abnormality

Type of Materials	Type of Abnormality
Steel member	Corrosion, fissure, breaking, other
Concrete member	Cracking, floor slab cracking, other
Other	Malfunction of bearings, other

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

2-5-1-1 Obligation of Japan

The implementation of the project will require a total cost of 2.5 billion yen, and the breakdown of the expenses to be borne by Japan is estimated to be as shown in Table 2-5-1, based on the estimation conditions given below. However, this amount does not indicate the limit of grant as described in the Exchange of Notes (E/N).

Table 2-5-1 Project Cost (Japanese Obligation)

Confidential

Source: JICA Study Team

2-5-1-2 Obligation of Recipient Country

The items of expenditures and amounts to be borne by Indonesia are shown in Table 2-5-2.

Table 2-5-2 Item and Cost of Recipient Country

Item to be borne	Content	Amount to be borne (million yen)	Amount to be borne (IDR)	Remarks
Bank fees		2.00	300,000,000	
Land acquisition cost		110.00	8,250,000,000	29,400 m ²
Facility relocation cost	Power pole Electric cable	5.00	750,000,000	
Total		117.00	9,300,000,000	

*Above items and costs will be determined after completion of environmental survey, thus, their cost will be tentative.

Source: JICA Study Team

2-5-1-3 Conditions for Cost Estimates

- Time of estimation: April 2019
- Exchange rate : 1 USD (TTS rate) = 111.62 yen
: IDR (TTS rate) = 0.006607 yen
- Construction & procurement periods: See Table 3-2 20
- Other: Estimation is conducted based on the scheme for the grant aid cooperation of the Government of Japan.

2-5-2 Operation and Maintenance Cost

The main part of the maintenance services for the bridge reconstructed through this project will involve the need for regular bridge inspection, routine inspection of retaining walls, work on slope face, weeding, cleaning and repair of draining facilities, repair of pavement, and other work. The frequency various types of inspection shall be once yearly for regular inspection, once weekly for routine inspection, and once in the 7th year for replacement of pavement as a rule.

Table 2-5-3 Operation and Maintenance

Item	Frequency	Inspected parts	Content of work	Estimated cost	remarks
Routine inspection	Once/week	Bridge Retaining wall structure Draining facilities Road shoulder, slope face Pavement	Visual Visual Debris removal Weeding Repair of cracks and potholes	7,500,000 IDR/week	
Regular inspection	Once/year	Bridge Retaining wall structure Traffic safety facilities Road shoulder, slope face Pavement	Visual, hammering Visual, surveying, hammering Repainting of road markings and signs Repainting of safety fences Visual, measurement, observation	75,000,000 IDR/year	
Repaving	Once/7 years	Pavement	Replacement of pavement	4,500,000,000 IDR/7 years	
Sum of maintenance cost needed every year	90,000,000 IDR/years				
Sum of maintenance cost needed once in 5 years				4500,000,000 IDR/5 years	
Sum of maintenance cost needed once in 7 years				4,500,000,000 IDR/7 years	

Source: JICA Study Team

Chapter 3 Project Evaluation

3-1 Preconditions

The preconditions for project implementation are as follows. In addition, the relocation and removal of obstacle properties, as well as compensation and the written approval of relevant authorities, need to be started after E/N and completed before the announcement of prequalification examination of constructors as a rule.

- Land acquisition is necessary for the implementation of this project. Details are described in “2-2-3-2 Land Acquisition and Relocation of Inhabitants” of this report. Land acquisition and compensation must be completed before the announcement of bid for the construction work.
- The project requires assistance and cooperation in customs clearance procedures for procured materials and equipment, which may cause delay in construction work, as well as prompt implementation of tax exemption procedures. In addition, tender method and contract method according to the grant aid cooperation guidelines must be observed. These matters that should be performed by PU are described in detail in “3-3 Outline of Obligations of Recipient Country” of this report.
- After the completion of the construction work in this project, the Indonesian side needs to conduct maintenance to ensure smooth traffic and the safety of the reconstructed bridge. Maintenance includes routine inspections and regular inspections, and it is important to make appropriate repair in a timely manner when any damage is found. Therefore, it is necessary to execute maintenance on an ongoing basis by securing personnel and budget needed for operation and maintenance. These matters that should be conducted by PU and Bina Marga are described in detail in “3-4 Project Operation and Maintenance Plan” of this report.

3-2 Necessary Inputs by Recipient Country

The recipient country should address the following matters to realize and sustain project effects.

- For the purpose of ensuring smooth execution of this project, the Indonesian side should secure the budget in advance as described in “2-3 Outline of Obligations of Recipient Country” of this report.
- For the purpose of securing the function of the facilities constructed in this project, the Indonesian side should assign personnel who take charge of annual budgeting and maintenance work after the completion of this project as described in “2-4 Project Operation and Maintenance Plan” of this report.

3-3 Important Assumptions

To realize and sustain project effects, it is necessary to ensure safe and stable traffic through appropriate operation and maintenance of roads not only on the Palu 4 Bridge reconstructed in this project but also throughout the bayside road.

3-4 Project Evaluation

3-4-1 Relevance

(1) Consistency with Upper Level Plans in Indonesia

Indonesia has been formulating 5-year development plans starting from the National Long-term Development Plan in 2004, and the proposals in these plans have been implemented. The current plan is the 3rd National Development Plan (2015-2019).

Development plans have been implemented based on their planning visions, and the 3rd National Development Plan has established three execution strategies with outputs defined for each indicator. This project takes place during the period of the 3rd National Development Plan, which includes the inter-national connectivity enhancement strategy exemplified by the implementation of the Sumatra-Java Corridor programme. It is the corridor programme to develop connections from Banda Aceh in the northern part of Sumatra and Lampung in the southern part, as well as from Merek in the western part of Java to Ketapang in the eastern part.

The Greater Sulawesi Corridor Programme, which plans to develop connection from Manado in the northern part of Sulawesi Island to Makassar in the southern part, has been implemented on Sulawesi Island, where this project is implemented. The segment from Manado to Palu was opened to traffic during the period from 2012 to 2016, and the segment from Palu to Makassar is planned to be developed in the future. Palu City, where this project is conducted, is located in the Central Sulawesi Province, which is an area forming a part of the Greater Sulawesi Corridor Programme in the framework of the 3rd National Development Plan. Although national roads are constructed to pass through Palu City in the east-west direction, there is only one national road crossing the Palu River flowing through the city, and the need for the expansion of traffic capacity is an important issue in this situation. One of the purposes of this project is to strengthen the road network for traffic in the east-west direction.

This project, therefore, is in line with the policies of the upper level plans of Indonesia.

(2) Consistency with Assistance Policy in Japan

A basic policy of Japan is to implement high-quality infrastructure development for the purpose of supporting the economic development of Indonesia. This project intends to reconstruct the Palu 4 Bridge using the design standards of Japan in the former site of the Palu 4 Bridge that collapsed during the earthquake in September 2018. The collapse of the Palu 4 Bridge, which had been essential to the traffic in the east-west direction in Palu City, made it necessary to reestablish traffic in the east-west direction.

The reconstruction will make it possible to reestablish traffic in the east-west direction as before the collapse of the Palu 4 Bridge. Although inter-city national roads are constructed in the city in the road development plan for Central Sulawesi Province, there is only one national road crossing the Palu River in the east-west direction, and the strengthening of the road network in the east-west direction is therefore important for the improvement of convenience of inter-city transport. For the future, the use of seismic design according to the Japanese standards in Indonesia, where the development and implementation of earthquake resistance standards is insufficient, will lead to the provision of high-quality infrastructure development.

This project, therefore, is in line with the assistance guidelines and policies of Japan.

(3) Urgency of the Project

The Provinces in Sulawesi have been implementing the Greater Sulawesi Corridor Programme, which is planned to connect the northern city of Manado to the southern city of Makassar, in the Third National Development Programme. The segment from Manado to Palu in the project area has been opened to traffic by fiscal year 2016. For the future, the programme is planned to proceed with the opening of the segment from Palu to Makassar.

In Palu City, which is the target area of the project implementation, the Palu 3 Bridge located approximately 800 m south of the fallen Palu 4 Bridge can be used only by the traffic from east to west. Similarly, the Palu 1 Bridge located approximately 1,600 m to the south can be travelled only from west to east. The only bridge that can carry two-way traffic is Palu 2 Bridge located approximately 4,200 m to the south. Thus, the collapse of the Palu 4 Bridge has made it an urgent issue to establish the traffic in the east-west direction, as the traffic in the coastal area is forced to detour southwards in the present situation.

This project is expected to help re-establish the traffic in the east-west direction in Palu City, to play an important role in the implementation of the Greater Sulawesi Corridor Programme by enhancing the inter-city road network, and also to contribute to economic recovery and development through improvement of physical distribution.

(4) Introduction of Japanese Advanced Technologies

Japan and Indonesia share common characteristics that they are adjacent to plate boundaries and active volcanos exist in densely populated areas. While infrastructure development and construction of housing complexes in Japan are conducted according to earthquake resistance standards, the suburban areas of Indonesia are still populated with many brick buildings without sufficient earthquake countermeasures. In addition, there are few researchers and experts specializing in earthquakes Indonesia, and the development and implementation of earthquake resistance standards have not been sufficient.

Japan is affected by many natural disasters, which include not only earthquakes but also typhoons, floods, and landslides. In particular, it is a country of many earthquakes, recording 20% of magnitude 6 or

stronger earthquakes in the world. Making use of lessons learned from previous earthquakes, bridges in Japan have been improved through various measures such as the revision of standards and installation of collapse prevention structure and equipment in response to the Great Hanshin-Awaji Earthquake that occurred in 1995. The use of seismic design according to the standards developed in Japan, which is a country with many earthquakes, will lead to technology transfer to Indonesia, which is also affected by frequent earthquakes, and is believed to contribute to the future development of earthquake resistance standards.

(5) Beneficial Population

Since this project involves the road crossing the Palu River achieving east-west connection, the users of this project (direct beneficiary population) are estimated to be extensive. However, if we limit it to the area within Palu City, where the Palu 4 Bridge is constructed, the number will be approximately 380,000 persons.

Table 3-4-1 Beneficial Population

District	Population	
	2016	2017
Palu Barat	61,424	62,293
Tatanga	39,369	39,997
Ulujadi	27,319	27,763
Palu Selatan	69,492	70,571
Palu Timur	70,378	71,452
Mantikulore	62,822	63,804
Palu Utara	22,834	23,196
Tawaeli	20,382	20,706
Total	374,020	379,782

Source: JICA Study Team

3-4-2 Effectiveness

(1) Quantitative Effects

Quantitative effects of this Project are shown in Table 3-4-2.

- The detours to Palu 3 Bridge (west-bound traffic) and Palu 1 Bridge (east-bound traffic) are eliminated, and two-way two-lane traffic will become possible.
- Travel distance will be shortened by 1.2 km for west-bound traffic and by 1.8 km for east-bound traffic as compared with the detour routes.

Table 3-4-2 Quantitative Effects of the Project

Indicators	Current (2016)	3 years after project completion (2024)
Lane Number	-	2 lanes
Operation	-	2-way (1 lane for each direction)
Travel Distance (Palu-Donggala Road ~ Munif Rahman Road) *1	Bound for West: 6.1km Bound for East: 6.8km	Bound for West: 4.9km Bound for East: 4.9km

*1: The routes in 2019 are assumed to pass the Palu 3 Bridge for west-bound traffic and the Palu 1 Bridge for east-bound traffic, because the collapsed Palu 4 Bridge is unavailable.

Source: JICA Study Team

(2) Qualitative Effects

➤ Improvement on Living surrounding the Project Site

The implementation of this project will strengthen the road network, improve accessibility in the area, improve physical distribution, and provide places of refuge in the event of a tsunami, contributing to the improvement of the living conditions and safety of local inhabitants.

➤ Acceleration of Economic Activities surrounding the Project Site

The implementation of this project is expected to eliminate traffic restrictions, facilitate traffic and physical distribution, and revitalize the exchange of people and goods, and the bridge reconstructed in this project will also be a symbol of recovery, contributing to the development and promotion of local economy.

➤ Reduction of Traffic Accidents

The construction of a two-way two-lane road according to the Indonesian standards will provide safe and stable road infrastructure, contributing to the reduction of traffic accidents.

➤ Reduction of Maintenance Cost

The use of seismic design incorporating Japanese standards and technologies is expected to improve disaster resilience, enable cost reduction in large-scale repair, and lead to the effective use of limited budget.

Directorate General of Highways
Ministry of Public Works and Housing
Republic of Indonesia

**The Preparatory Survey on the
Programme for the Reconstruction of
Palu 4 Bridges
in Central Sulawesi Province**

OUTLINE DESIGN REPORT

APPENDIX

May 2019

Japan International Cooperation Agency

**Oriental Consultants Global Co., Ltd.
Yachiyo Engineering Co., Ltd.**

Appendix

Environmental Checklist: Bridge

Category	Environmental Item	Main Check Items	Yes: Y No: N Not applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1. Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N (d) N	(a) The project is required to prepare the UKL-UPL report under the Law No. 32 of 2009 on Protection and Management of Environment. The project implementation body, Balai BINA MARGA, is preparing the UKL-UPL report with the support of JST. It will be approved at the end of August 2019. (b) Ditto (c) Incidental conditions will become apparent upon UKL-UPL approval. (d) Not applicable.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) At the end of June 2019, a stakeholder meeting will be held by Balai BINA MARGA as project implementation agency and Palu City as the land acquisition responsible agency. (b) Comments in the stakeholder meeting will be reflected in the project contents.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) From January 2019, alternatives such as the location of the target project and road structure were proposed and were compared including environmental and social items. The reconstruction of the existing broken bridge as a priority project was selected in February 2019. As a result of comparing the three plans of the bridge location and the case without the project, the existing project was selected as the best alternative.
2. Pollution	(1) Air quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) If air quality already exceed country's standards near the route, is there a possibility that the project will make air pollution worse?	(a) N (b) N	(a) The project is the reconstruction of the Palu IV bridge destroyed by the earthquake. Air quality condition in the project area is unlikely to degrade more than before the earthquake. (b) Ditto

Category	Environmental Item	Main Check Items	Yes: Y No: N Not applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that the project will contaminate water sources, such as well water?	(a) Y (b) N	(a) A possibility that turbid water may be generated by embankment work of access road and bridge pier work (excavation) in the riverbed. The planned location is the closest to the river mouth, and turbidity water may occur in the inner part of the Palu Bay. (b) The planned location is the closest to the river mouth. In the project area, no impact as wells and surface water are not used as water sources.
	(3) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards? (b) Do low frequency sound from the vehicle and train traffic comply with the country's standards?	(a) Y (b) Y	(a) The project is the reconstruction of the Palu IV bridge destroyed by the earthquake. Noise and Vibration condition in the project area is unlikely to degrade more than before the earthquake. (b) The project bridge is about 260 m long and has two girders. The impact on low frequencies is not significant by the project.
3. Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project area has a sufficient distance from the protected area and no negative impact on protected area is to be anticipated.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of bridges and access roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?	(a) N (b) N (c) N (d) N (e) N	(a) Not applicable. (b) Not applicable. (c) The significant ecological impact is not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake. (d) The significant impact on disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock is not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake. It is planned to carry out the construction in the river during the construction period without changing the river. Significant impact on the sustainable survival of aquatic organisms is not expected. (e) The project is the reconstruction of the Palu IV bridge destroyed by the earthquake. Therefore, the existence of the reconstruction bridge will not cause new deforestation and other effects.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the installation of structures will adversely affect surface water and groundwater flows?	(a) N	(a) The significant impact on surface water and groundwater flows by hydrologic changes due to the installation of structures will not be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake.
	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) N (c) N	(a) The slope failures and landslides by the project are not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake. (b) The slope failures and landslides by civil works are not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake. (c) The soil runoff from cut and fill areas, waste soil disposal sites, and borrow sites are not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake.
4. Social environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous people? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	(a) N (b) Y (c) Y (d) Y (e) Y (f) N/A (g) N/A (h) Y (i) Y (j) Y	(a) Right bank area will use the existing ROW, no impact on residential buildings and no involuntary resettlement will occur. Left bank area will use the affected area by the tsunami disaster as the project site. As houses located at the project site on the left bank already have been destroyed by the tsunami disaster. Therefore, removal of buildings by the project and involuntary resettlement does not occur. (b) The project will not cause the resettlement, but small scale land acquisition will be required. Negotiation of land acquisition for the project is likely to be conducted individually due to scale by land acquisition section of Palu City. Regarding compensation and necessary support, an appropriate explanation will be implemented based on the Indonesian law and JICA guidelines in the stakeholder meeting in the site. (c) The project will not cause the resettlement, but small scale land acquisition will be required. The land acquisition will be implemented appropriately based on Indonesian law and JICA guidelines. (d) Based on Indonesian law, payment of compensation is expected to be made prior to the transfer of land rights. (e) Negotiation of land acquisition for the project is likely to be conducted individually due to scale by land acquisition section of Palu City. If land acquisition plan will not be prepared, JET will recommend to Palu City preparing a written description of the individual compensation policy.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?		(f) The project will not cause the resettlement. (g) The project will not cause the resettlement. (h) Palu City as responsible section of land acquisition is preparing for the set of the organization and budgetary arrangement for public work. Palu City mayor has promised to the land acquisition by Palu City, and procedures and budget arrangement will be properly implemented. (i) Monitoring of land acquisition procedure will be implemented under Indonesian law/UKL-UPL report. (j) Grievance redress mechanism will be established based on Indonesian law/UKL-UPL report.
	(2) Living and Livelihood	(a) Where bridges and access roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that project will impede the movement of inhabitants? (f) Is there any possibility that bridges will cause a sun shading and radio interference?	(a) N (b) N (c) Y (d) Y (e) Y/N (f) N	(a) Not applicable. The project is the reconstruction of the Palu IV bridge destroyed by the earthquake. (b) The significant impact on living condition due to the project will is not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake. (c) UKL-UPL report will propose the contents of adequate consideration for standard public health for road and bridge construction. (d) During the construction phase, the existing roads will need to be closed and circumscribed. The closure will affect the traffic condition on the surrounding roads. During the operation phase, road traffic in the surrounding area will be improved because the bridge destroyed by the earthquake will be reconstructed. (e) Ditto (f) The project site is located at Zero degree south, and it is not to be expected to cause a sun shading. The bridge's structure and scale will not cause radio interference.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(g) N	(a) The significant impact on the local archeological, historical, cultural, and religious heritage is not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The significant impact on local landscape is not to be expected since the project is the reconstruction of the Palu IV bridge destroyed by the earthquake.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a) Not applicable. The people of Palu city are mainly the local ethnic group, Kaili tribe. Since the project area is an urban area, the mixture with other ethnic groups is progressing, and the area has not been identified to have a special culture and life. (b) Not applicable.
	(6) Working condition	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The project proponent will comply with laws and regulations related to employment conditions of the National Labor Law, IFC guidelines, EHS guidelines of World Bank, and others. (b) For project concerned personnel, specific safety methods such as the installation of safety equipment to prevent occupational accidents and management of hazardous substances will be implemented. (c) The project will obligate that construction contractors implement safety and environmental education programs for construction workers including security guards. (d) Ditto
5. Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are	(a) Y (b) N (c) Y	(a) Mitigation measures during the construction phase will be described in the UKL-UPL report. (b) The site survey of the planned area downstream of the bridge is under planning. However, the natural environment (ecosystem) that should pay particular attention to the project site and the surrounding area has not been found in the current phase. (c) The negative impact on the social environment during construction and the mitigation measures for the impact will be described in the UKL-UPL report.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program?	(a) Y (b) Y (c) Y (d) Y	(d) UKL-UPL report is EMP & EMOP document by the project proponent, and the monitoring detailed plan will be specified in the report. (e) UKL-UPL report will consist of the EMP and EMOP, and items, methods, and frequency are specified.

Category	Environmental Item	Main Check Items	Yes: Y No: N Not applicable: N/A	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?		(f) UKL-UPL report will describe the proponent monitoring system. (g) The format and frequency of the monitoring report will be specified in the UKL-UPL report.
6. Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Roads, Railways and Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a) N/A (b) N/A	(a) Not applicable. (b) Not applicable
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) Not applicable.

- 1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
- 2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.