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Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
				Yangon,
		(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	(c) Y	(c) According to instruction from Forest Department, MOECAF, removal and/or relocation or replanting trees including these two species, at first to submit application letter including data of tree species, location and numbers of trees, to the Department for obtaining permission. In the project plan, these trees will be avoided to remove, etc. as much as possible. If it is unavoidable, actual activities shall be required to YCDC-PPGD (Playgrounds, Parks and Gardening Department) with prescribed paying.
		(d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock?	(d) N/A	(d) Because the project site is located in developed urban area, the Project does not cause 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?	(e)N/A	(e) Not applicable. Because the project site is located in developed urban area, the Project does not cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems.
		(f) In cases where the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(f) N/A	(f) Not applicable. (The Project site is not located at undeveloped areas.)
	(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) Alternation of land and the installation of structures on the river bank are limited in the end of the bridge, and scale is not large. The installation of structures in the river is abutments piers, and scale is not large. These construction activities are expected to affect slightly on surface water and groundwater flows.
	(4) Topography and Geology	(a) Is there a soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?	(a) N	(a) There is no slope land within the Project site which causes slope failures or landslides.
		(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?	(b) N	(b) Because the elevation structure of access roads is vertical retaining wall, there is almost no cutting and filling activities .

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Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
		(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?	(c) N	(c) Because the structure of access roads is vertical retaining wall, there will be almost no cutting and filling activities. Most aggregates are taken from the existing borrow pit far from the Project site. Accordingly, soil runoff from rarely occurs from the Project site.
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?	(a) Y	(a) Involuntary resettlement of two groups (five persons) and seven removal/ replacement of properties caused by the Project implementation. However, Effort was made to reduce the impact as much as possible.
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	(b) Y	(b) Explanation on land acquisition and compensation was given to PAPs on stakeholders meeting and direct communications.
		(c) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	(c) Y	(c) PW shall develop the ARP (Abbreviated Resettlement Plan) that includes proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement. Compensation should be made with full replacement costs, restoration of livelihoods and living standards.
		(d) Is the compensations going to be paid prior to the resettlement?	(d) Y	(d) The compensations shall be paid in cash by pw prior to land acquisition.
		(e) Is the compensation policies prepared in document?	(e) Y	(e) The compensation policies were written on the explanation document of the stakeholders meeting and are written on the ARP.
		(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 peoples?	(f) Y	(f) The ARP will pay particular attention to vulnerable groups or people and indigenous peoples.
		(g) Are agreements with the affected people obtained prior to resettlement?	(g)Y	(g) Agreements with PAPs can be obtained prior to Structures removing land Resettlement.
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	(h)Y	(h) PW has established a team with necessary capacity and budget to implement the ARP. PW get the participation of relevant institutions in Compensation Fixation committee that is hosted by PW.
		(i) Are any plans developed to monitor the impacts of resettlement?	(i) Y	(i) The monitoring plan for monitoring the livelihood of PAPs is developed by PW.
		(j) Is the grievance redress mechanism established?	(j) Y	(j) PW will create the position of the grievance redress in the team.

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Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
	(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?	(a) N	(a) The project is intended to build a four-lane bridge that is close to the upstream side of the existing bridge. There is no impact on the residents to existing means of transportation and the associated workers. There is also no possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment.
		(b) Is there any possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	(b) N	(b) There is no factor in the Project activities that adversely affects the living conditions of inhabitants other than PAPs.
		(c) Is there any possibility that diseases, including communicable 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?	(c) N	(c) In construction stage, there is the possibility that infectious diseases, such as HIV, will be brought due to the migration of construction workers. Mitigation measures are described in 5. Others (1) Impacts during Construction
		(d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increases of traffic congestion and traffic accidents)?	(d) Y	(d)There is no possibility that the Project will adversely affect road traffic in the surrounding areas in operation stage. However, There is a small possibility that traffic accidents are increase by transportation vehicles. Construction of the new bridge is expected to have positive impact in increasing of potential traffic volume and in dissolving current congestion problem.
		(e) Is there any possibility that bridge and access roads will impede the movement of inhabitants?	(e) N	(e) There is no possibility that bridge and access roads will impede the movement of inhabitants. The structure and alignment of the bridge and access roads are designed as being convenient for the movement of inhabitants.
		(f) Is there any possibility that bridges and access roads will cause a sun shading and radio interference?	(f) N	(f) Influence of the bridge and access roads on a sun shading radio interference seems to be minor, because the height of maximum elevation and vertical retaining wall of access roads is not so high.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There are no significant local archeological, historical, cultural, or religious heritage sites in and around the Project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There is no landscape element to need special consideration. Since existing bridge and new bridge stand side by side for a period of time. However, There is not a particular

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Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
				disharmony in the new and old bridges aesthetic.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	(a) Y	(a) Considerations have given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples. (There is no activity within the Project site that would particularly affect 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?	(b) Y	(b) All of the rights of ethnic minorities and indigenous peoples in relation to land and resources have been respected in the Project. (No residential areas of ethnic minorities and indigenous peoples are observed in the Project site.)
	(6) Working Conditions	(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?	(a) Y	(a) PW and the contractor shall be not violating the Myanmar Regulations that covers working conditions, the welfare of workers and safety and health.
		(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?	(b) Y	(b) During construction period, tangible safety considerations are taken in place for individuals involved in the Project. Tangible safety measures should be taken as follows. -Installation of safety equipment which prevents industrial accidents - Physical zoning for of safety work area.
		(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.?	(c) Y	(c) Intangible safety measures should be taken as follows. - The contractor should prepare safety and health management plan, including traffic safety, accident prevention and public sanitation, etc. according to the regulations relating to working conditions. - The contractor should conduct educational training of safety, health and public sanitation to workers and staffs.
		(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?	(d) Y	(d) The contractor should implement proper and strict management and education of guards not to infringe safety and security of residents, staff and workers.
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)?	(a) Y	(a) a1) Noise and vibrations (generated by transportation vehicles/ vessels and heavy machines) - Maintenance of vehicles/ vessels and heavy machines is improved sufficiently and operate them on low-noise/ vibration condition. - If necessary, install soundproof fence or buffer zones. - Consideration and restriction of working time in the morning and at night.

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Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
				a2) Air pollution (caused by transportation vehicles/ vessels and heavy machines) - Vehicles/ vessels and heavy machines use good quality fuel and oil. - Consideration and restriction of working time in the morning and at night. a3) Water Pollution - High turbidity water shall not be discharged intensively at a time without waiting precipitation of sand and earth. Steel sheet pile method shall be effectively operated. - Transport vehicles, construction heavy machines shall be used so as not to leak oil. Waste oil is disposed of safely in storage. a4) Wastes - Construction waste and waste from worker's camp shall be collected, segregated properly reused and recycled according to regulations and rules of YCDC. Then remained waste will be transferred to designated dumping site for final disposal. - The contractor shall provide education and enlightenment for above activities (decreasing quantity, segregation, reuse and recycling) to workers. - Remaining sand and soil should be backfilled in principle. - Waste which are not prescribed in the regulations and rules and cannot be treated or disposed in the areas should be brought back by the contractor and treated and disposed appropriately according to the local government of area where the wastes are carried in..
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	(b) Y	(b) In the planned area of the access road one vulnerable species of the Red List of IUCN, Delonix regia (Seinban/ Flame tree) exists. And though other than vulnerable species of the Red List of IUCN, a lot of trees exist in the planned area of the access roads. For removal and/or relocation or replanting trees including vulnerable species It shall be taken necessary procedure according to the regulation and instruction of Forestry Department of MOECAF that described in "3 Natural Environment, (2) Ecosystem".
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(c) Y	(c) c1) Road congestion and traffic access failure - Public notice prior related to temporary traffic restrictions - If necessary, time shift of activities of construction or operation of transport

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Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
				vehicles. c2) Public health and sanitation - Air contaminants SPN, NOx, and SOx, etc. will be exhausted from transport vehicles/ vessels and construction heavy machines. It is an only slight possibility that respiratory diseases due to the air contaminants occur. But, it shall be taken consideration of mitigation measures such as limit of construction activities in the morning and at night and using low exhaust gas fuel for vehicles/ vessels and heavy machines - If the public toilet is not available, mobile type temporary toilets are prepared for construction worker. c3) There is the possibility that infectious diseases, such as HIV, will be brought due to the immigration of construction workers. Mitigation measures are as follows. - HIV education for construction workers and residents - Regional workers will be hired preferentially as much as possible. c4) Accidents (relating to transportation vehicles/ vessels and heavy machines or construction activities) Notify the construction plan (details of construction works, schedule and place) to the residents of the areas around the construction sites. Putting up a notice about the details above on the roadside. Clarification of the boundaries of the construction areas with rope, fences, and other means.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	(a) Y	(a) PW developed the monitoring program by obtaining the support of JICA survey team. PW will implement the program run from the start of the construction works.
		(b) What are the items, methods and frequencies of the monitoring program?	(b) Y	(b) In the monitoring program, the items, methods and frequencies and other relevant details are clearly described.
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	(c) Y	(c) PW will establish the monitoring framework (team, responsible person, budget, etc.).
		(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?	(d) Y	(d) PW will develop monitoring (including frequency of reports from to the regulatory authorities).

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Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
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) Y (b) N/A	(a) Because the Project is subject to the construction of bridge and access roads, Adding to Bridge checklist, pertinent items described in the Roads and River/ Sand Erosion Control are also checked. Items described in the Railways and Forestry is 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) Y	(a) Since emission of greenhouse gases such as CO_2 from transportation vehicles and heavy machines used in construction works are quite little and temporary, the impacts to transboundary or global issues are estimated to be negligible.

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 the project is located.

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Annex 5

Monitoring Form

Category	Environmental Item	Measurement Point	Period (from dd/mm/yyyy to dd/mm/yyyy)	Frequency	Results -Qualitative Data -Quantitative Measurement Data (Min, Max, Average)	Results -Comments -Responses/Actions to Comments and Guidance from the Public (with date)
(1) Planning Stage						
Social Environment	Level of livelihood					
Natural Environment	Trees (including Flame tree)					
(2) Construction Stage						
Social Environment	-- Temporal closure of roads, one-way reduction and speed limit in construction -Other traffic problem					
	Public health and Sanitation					
	Infectious diseases such as HIV/AID					
	Accidents					
Environmental Pollution	Air quality					
	Quantitative measurement					
	Qualitative Monitoring					
	Water quality					
	Quantitative measurement					
	Qualitative monitoring					
	Noise					
	Quantitative measurement					
	Qualitative Monitoring					
	Waste					

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Category	Environmental Item	Measurement Point	Period (from dd/mm/yyyy to dd/mm/yyyy)	Frequency	Results (Qualitative Data, Quantitative Measurement Data (Min, Max, Average))	Results (Comments, Responses/Actions, Comments and Guidance from the Public (with date))
	Construction Waste					
	General daily waste					
(3) Operation Stage						
Social Environment	Public health and Sanitation					
	Accidents					
Natural Environment	River stream regime, river bank erosion (scour)					
Environmental Pollution	Air quality Quantitative measurement					
	Noise Quantitative measurement			r		

Appendix 5 Technical Notes (T/N)

Preparatory Survey on the Project for Construction of New Thaketa Bridge

Date & Time		March 6, 2014 1:30 pm
Visit Details	Organization	Public Works
	Participants	See Attendance List
	Venue	Public Works (Head Office)
Participants from JICA and Project Team		See Attendance List
Main Topics	Technical Notes to be confirmed	
Result of Discussion	The technical conditions listed below were confirmed and agreed.	
Documents	Presentation Handout Drawings	

Technical Notes to be confirmed for Design of New Thaketa Bridge and Approach Roads

1. Design Conditions

(1) Main Carriageway

(i) Horizontal Geometry

Design Speed: 50 km/h

Horizontal Radius: Minimum 100m

Horizontal Relaxation Curve: Minimum 40m

(ii) Longitudinal Geometry

Longitudinal Slope: Maximum 6%

Longitudinal Radius: Minimum 1200m/1000m (凸/凹)

Longitudinal Curve: Maximum 40m

(2) Ramps at Interchange

Design Speed: 30 km/h

Horizontal Radius: Minimum 25m

Horizontal Curve: Minimum 50m (including Relaxation Curve)

(3) Cross Section

Number of Lanes: 4 (four)

Width of Carriageway: 3.5m

Number of Walkways: 2 (two) on the both sides.

Width of Walkway: 2.0m

1 / 2

Preparatory Survey on the Project for Construction of New Thaketa Bridge

(2) Navigation Clearance (requested by MPA)

(i) Horizontal Navigation Clearance: Center Span Length = 100m

(ii) Vertical Naviation Clearance:

At least the same as the existing Thaketa Bridge (10.6m at the crest)

2. Bridge Type

(1) Superstructure

Main Bridge: PC 3-span Continuous Extradosed Type

South End Span: PC Box Girder Type

(2) Foundation

P1 & P2: Steel Pipe Sheet Pile Foundation

~~A1~~, P3 and A2: Cast In-situ Concrete Pile Foundation
A1.

3. Major Components of Scope of Works

Following components of the scope of works were confirmed by referring to the Drawing, Plan View (1/3); Road.

(1) New Thaketa Bridge and Access Road: L = 620m

(i) New Thaketa Bridge: L=253m

(ii) Access Road (North): L = 165m

(iii) Access Road (South): L =202m

(iv) Off Ramp East: L = 199m

(v) On Ramp West-1: L = 149m

(2) Approach Road (North) L = 320m

(i) Main Carriageway: L= 320m

(ii) On Ramp East: L=189m

(iii) On Ramp West-2: L= 118m

(iv) Off Ramp West: L=305m

(v) Floyover (Railway Over Bridge): L=40m (Tentative)

(vi) Floyover (Bridge over Upper Pazundaug Rd): L=34m (Tentative)

(3) Approach Road (South) L = 469m

4. Vertical Alignment of the Project

Vertical Alignment of the Project was confirmed by referring to the Drawings, General View.(1/3), (2/3) and (3/3)

5. Clearance for Bridgeover Upper Pazundaung Rd : ~~5.18m~~ 5.20m
To be Confirmed

2 / 2

Confirmed by:

Public Works Aung Myat Oo. JICA STUDY TEAM T. Yoshida

Technical Meeting

Attendance List 6.3.2014

ID No	Name	Position	Department	Signature
1	~~U AUNG~~			
1.	U Aung Myat Oo	CE	Bridge Department	
2	U SOE MIN	SE	Bridge Unit 4	
3.	Daw Than Yi	D.S.E	Bridge Department	
		Nippon Koei	JICA Study Team	
	Yoshida Takeshi	Bridge Eng.	Consultant Nippon Koei	
	AIKAWA [illegible]	Study Tea	"	
	Yuichi SANO	Asst Gen. Manager	"	
	T. Seki	Deputy DG	"	
	Ms. Aye Aye Khaing	Secretary	JICA Study Team.	
	Nobuyuki Tsuneoka	JICA	JICA HQ.	

Appendix 6 Soft Component Plan

(1) Background

The new bridge construction and road widening will achieve the objectives of the project, which are to eliminate the bottleneck in the road network that connects the Yangon City center and the east/southeast parts, and to improve the transportation conditions and quality for the people in the area.

The Yangon City Development Committee (YCDC) and the Ministry of Construction (MOC) will maintain the New Thaketa Bridge and approach roads. The improvement of the maintenance capacity of YCDC and MOC is required for the maintenance of the new bridge type. Therefore, support including the technical transfer of bridge maintenance skills will be implemented under the soft component of this project in order to secure and maintain the positive results from the construction of the new bridge.

(2) Objective / Target

The objective of the soft component is to improve the capacity of YCDC and MOC on maintenance of the New Thaketa Bridge.

(3) Result

The technical guidance for YCDC and MOC maintenance staff for the New Thaketa Bridge will achieve the direct results of the soft component, which are as follows:

The maintenance staff including administration staff can recognize the importance of daily/periodical inspections, understand the procedure and inspection point, and evaluate soundness of the new bridge.

(4) Methodology for Achievement of the Results

The guidance is mainly indoor lecture for the staff.

Table Quantitative Effectiveness of the Project

Content	Result	Confirmation Method	
		Method	Confirmed by
General Bridge	Daily/Periodical Inspection Skill	Confirm staff's understanding by question and answer, and questionnaire for staff	Bridge Specialist
Special Bridge	To learn factors of deterioration and function of non-destruction To acquire the maintenance method for the actual case of damage on cable	ditto	ditto

Source: JICA Study Team

(5) Activity (Input Plan)

The activity has two parts. The first part involves the guidance for the staff in charge of daily/periodical inspection on site regarding the actual inspection skill for general bridge using the substructure of the New Thaketa Bridge during construction and other existing bridges. The second part is for the guidance of the engineering staff and supervisor for maintenance work regarding the inspection methodology for cable tension work using the bridge superstructure during construction. Two Japanese specialists will be assigned for the activity.

1) Bridge Specialist: One person for guidance on general bridge maintenance
   - For Daily/Periodical Inspection Skill
2) Bridge Specialist: One person for guidance on special bridge maintenance
   - To learn factors of deterioration and function of non-destruction
   - To acquire maintenance method for actual case of damage on cable

(6) Procurement for the Resource

The extradosed bridge is not constructed in Myanmar. There is no specialist for the maintenance of the extra cable with concrete box bridge in Myanmar. The bridge specialist will be procured from Japan by the Japanese consulting company which will implement the supervision.

(7) Implementation Schedule

Guidance for general bridge: September 2015

Guidance for special bridge: September 2017

1) Duration for each guidance is 15 days.
2) Field investigation: 3 days
3) Confirmation of the contents of the guidance: 2 days
4) Preparation of documents for guidance and questionnaire: 5 days
5) Implementation of guidance: 2 days
6) Preparation of the summary of the question and answer, and completion report: 1 day
7) Travel time to Japan: 2 days

(8) Outcome Document

Distributed documents for the guidance on bridge maintenance

Completion report for the soft component

(9) Implementation Cost

The cost for the two Japanese specialists is estimated in the following table. The estimated cost is included in the consultant agreement amount to be borne by the grant aid. The cost for the preparation of the documents is included in the general expense for the Japanese specialist.

Table Implementation Cost

Items		Unit	Quantity	Unit Price (JPY)	Amount (JPY)
Direct Cost	Air Ticket: Japan	L.S.	1	654,147	654,147
	Accommodation/Allowance	L.S.	1	415,600	415,600
Remuneration	Class 3	Month	1.0	778,000	778,000
Indirect Cost	General Expense	L.S.	1	700,200	700,200
	Technical Expense	L.S.	1	295,640	295,640
Total					2,843,587

Source: JICA Study Team

(10) Obligation of the Recipient Country

The Myanmar side is to bear the cost for the YCDC and MOC staff, transportation to the site surveys, and the appropriate room for the guidance under the soft component.

YCDC and MOC are required to secure staff/team for the New Thaketa Bridge's maintenance after its completion.

YCDC and MOC are required to establish the organization for the proper maintenance of the New Thaketa Bridge to implement the inspection, record the inspection results, and undertake repairs/appropriate actions based on the inspection results.

Appendix 7 Reference for Environmental and Social Considerations

1.3.1 Environmental Impact Assessment

(1) Environmental and social baselines (Item number of the body text, following the same)
Appendix 1.1 Actual Field Survey of Flora/ Fauna and Ecosystem
Appendix 1.2 Actual Measurements of Environmental Pollution
Appendix 1.3 Social Environment
(2) Systems and organizations concerned with environmental and social considerations in Myanmar
Appendix 1.4 Outline of the "EIA Procedures (Draft)"
Appendix 1.5 Outline of Organization Related to Environmental Conservation in Myanmar
(3) Comparative consideration of alternatives
Appendix 1.6 Comparative Consideration of Alternatives
(4) Scoping
Appendix 1.7 Results of the Scoping
(5) TOR of the surveys on environmental and social considerations
Appendix 1.8 TOR of Surveys on Environmental and Social Considerations
(6) Results of the survey on environmental and social considerations
Appendix 1.9 Results of the Survey on Environmental and Social Considerations
(8) Mitigation measures and their costs
Appendix 1.10 Mitigation Measures and Their Costs
(9) Environmental management plan and monitoring plan
Appendix 1.11 Monitoring Plan
(10) Stakeholders Meeting
Appendix 1.12 Minutes of the Stakeholders Meeting

1.3.2 Land Acquisition and Resettlement

(1) Necessity of structure relocation and resettlement
Appendix 1.13 Comparative Consideration of Alternatives
(2) Legal framework concerning land acquisition and resettlement
Appendix 1.14 JICA's Policy
(5) Entitlement Matrix
Appendix 1.15 Entitlement Matrix
(6) Grievance redress mechanism
Appendix 1.16 Grievance redresses mechanism
(7) Framework for implementation
Appendix 1.17 Framework for implementation
(8) Implementation schedule
Appendix 1.18 Implementation schedule
(9) Estimated cost and source of funds
Appendix 1.19 Estimated cost and source of funds
(10) Monitoring (Structures Replacement and Resettlement)
Appendix 1.20 Monitoring (Structures Replacement and Resettlement)

1.3.3 Others

(1) Monitoring Form (draft)
Appendix 1.21
(2) Environmental Checklist
Appendix 1.22
(3) Scoping and TOR of surveys on environmental and social considerations for the project of Myanmar portion
Appendix 1.23

Appendix 1.1 Actual Survey of Flora/ Fauna and Ecosystem in the Project

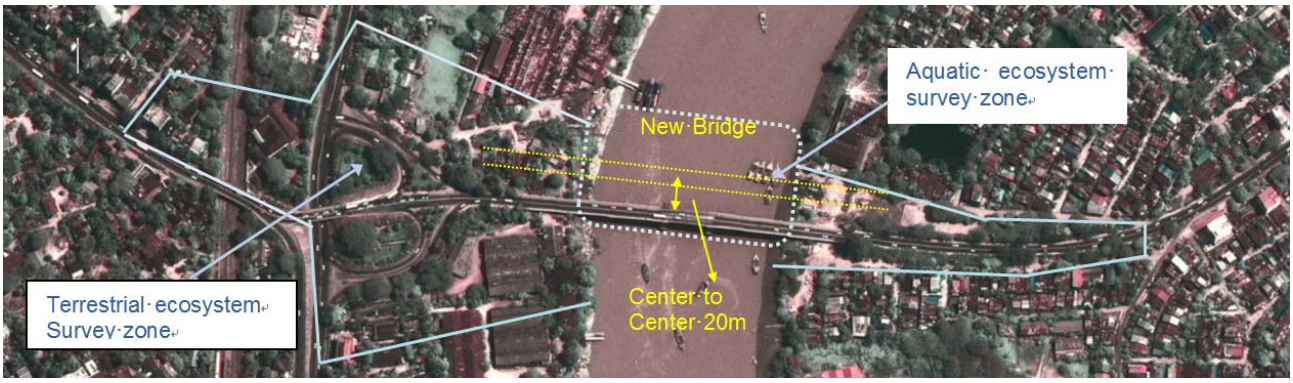
In the project the actual field survey of flora/fauna and ecosystem was conducted. The aim of the survey is to get data of current conditions of flora/fauna/ecosystem, and to use such data as baseline data for environmental impact assessment.

＜Period of the Survey＞

The survey was conducted on 7 December 2013 (Terrestrial Ecosystem), and 8 December 2013 (Aquatic Ecosystem).

＜Survey Area＞

The survey area is shown in Figure A1.1. The area covers the planned area of the project, and is wide.



Source: JICA Study Team

Figure A1.1 Survey Area for Flora/ Fauna

＜Result of the Survey＞

(a) Identified plant species in the survey area (terrestrial and aquatic flora)

Table A1.1 shows the identified plant species in the survey area.

The number of identified plant species is 104 in total including one aquatic plant (water hyacinth).

Table A1.1 Identified Plant Species in the Survey

No.	Scientific Name	Family Name	Vernacular Name	Habit
1	*Acacia auriculiformis* A. Cunn.	Mimosaceae	Malaysia-padauk	ST
2	*Acacia megaladena* Desv.	Mimosaceae	Subok	ST
3	*Achyranthes aspera* L.	Amaranthaceae	Kyet-mauk-pyan, Kyet-mauk-sue-pyan, Naukpo	H
4	*Acmella calva* (DC.) R.K. Jansen	Asteraceae	Shadon-po, Sein-nagat	H
5	*Aeschynomene indica* L.	Fabaceae	Nay-bin	H
6	*Ageratum conyzoides* L.	Asteraceae	Khwe-thay-pan	H
7	*Alternanthera nodiflora* R. Br.	Amaranthaceae	Kanaphaw	H
8	*Alternanthera sessilis* (L.) R. Br.	Amaranthaceae	Pazun-sar	H
9	*Amaranthus spinosus* L.	Amaranthaceae	Hin-nu-nwe-subauk	H
10	*Annona squamosa* L.	Annonaceae	Awza	ST
11	*Areca catechu* L.	Arecaceae	Kun-thi-pin	T

No.	Scientific Name	Family Name	Vernacular Name	Habit
12	*Artocarpus heterophyllus* Lam.	Moraceae	Pein -hne	T
13	*Averrhoa carambola* L.	Oxalidaceae	Zaung-ya	ST
14	*Borassus flabellifer* L.	Arecaceae	Htan	T
15	*Blumea hieracifolia* (D. Don) DC.	Asteraceae	-	H
16	*Blumea* sp.	Asteraceae	Kadu	S
17	*Caesalpinia pulcherrima* (L.) Sw.	Caesalpiniaceae	Seinban-gale	S
18	*Canavalia* sp.	Fabaceae	-	Cl, Cr
19	*Carica papaya* L.	Caricaceae	Thin baw	ST
20	*Cassia fistula* L.	Caesalpiniaceae	Ngu	T
21	*Cassia occidentalis* L.	Caesalpiniaceae	Kazaw-bok, Dant-kywe	S
22	*Casuarina equisetifolia* Forst.	Casuarinaceae	Pinle-kabwe	T
23	*Ceiba pentandra* (L.) Gaertn.	Bombacaceae	Hmo Pin	T
24	*Cephalandra indica* Naud.	Cucurbitaceae	Kinmon	Cl, Cr
25	*Chromolaena odorata* (L.) R. M. King & H. Robinson	Asteraceae	Bizat	S
26	*Citrus* sp.	Rutaceae	Shauk	ST
27	*Cleome burmanii* Wight & Arn	Capparaceae	Taw hingala	H
28	*Clitoria macrophylla* Wall.	Fabaceae	Taw-pe	Cl, Cr
29	*Commelina diffusa* Burm. F.	Commelinaceae	Myet kyut	H
30	*Corchorus* sp.	Tiliaceae	Taw-pilaw	S
31	*Cocos nucifera* L.	Arecaceae	Ohn-pin	T
32	*Coix lacryma-jobi* L.	Poaceae	Kyeik	G
33	*Colocasia esculenta* (L.) Schott	Araceae	Pein	H
34	*Curcuma* sp.	Zingiberaceae	-	H
35	*Delonix regia* (Bojer ex Hook.) Raf.	Caesalpiniaceae	Sein pan	T
36	*Dracaena fragrans* (L.) Ker Gawl.	Dracaenaceae	Zawgi taunghway	S
37	*Echinochloa* sp.	Poaceae	-	G
38	*Eclipta alba* (L.) Hassk.	Asteraceae	Kyeik-hman	H
39	*Eichornia crassipes* (Mart.) Solms	Pontederiaceae	Beda	Aquatic
40	*Eleusine indica* L.	Poaceae	Sinngo-myet	G
41	*Eugenia magacarpa* Craib	Myrtaceae	Thabye byu	T
42	*Euphorbia hirta* L.	Euphorbiaceae	Kywekyaung hmin say	H
43	*Ficus glomerata* Roxb	Moraceae	Ye thaphan	T
43	*Ficus glomerata* Roxb.	Moraceae	Ye thaphan	T
44	*Ficus hispida* L. f.	Moraceae	Kha-aung	ST
45	*Ficus religiosa* L.	Moraceae	Bawdi-nyaung	T
46	*Ficus rumphii* Blume	Moraceae	Nyaung	T
47	*Ficus* sp.	Moraceae	Nyaung	T
48	*Flueggea leucopyrus* Willd.	Euphorbiaceae	Chinya-pyu, Kon-chinya	S
49	*Girardinia heterophylla* Decne.	Urticaceae	Phet-ya	S
50	*Hedyotis corymbosa* (L.) Lam	Rubiaceae	-	H
51	*Heliotropium indicum* L.	Boraginaceae	Sin-hnamaung-gyi	H
52	*Hygrophila phlomoides* Nees	Acanthaceae	Migyaung kunbat	H
53	*Hyptis rhomboidea* Marts & Gal	Lamiaceae	-	S
54	*Ipomoea pilosa*Sweet.	Convolvulaceae	Kone-kazun-lay	Cl
55	*Ipomoea sagittata* Poir	Convolvulaceae	Kone-kazun	Cl
56	*Ipomoea* sp.	Convolvulaceae	-	Cl
57	*Ischaemum rugosum* Salisb.	Poaceae	-	G

No.	Scientific Name	Family Name	Vernacular Name	Habit
58	*Ixora* sp.	Rubiaceae	Ponna-yeik	S
59	*Jatropha curcas* L.	Euphorbiaceae	Chan-siyo-kyetsu	ST
60	*Kyllinga monocephala* Rottb.	Cyperaceae	-	G
61	*Lagerstroemia speciosa* (L.) Pers.	Lythraceae	Pyinma	T
62	*Lawsonia inermis* L.	Lythraceae	Dan-gyi-pin	S
63	*Leucaena leucocephala* (Lam.) De Wit	Mimosaceae	Baw-sa-gaing	T
64	*Ludwigia prostrata* Roxb.	Onagraceae	Lay-hnin	S
65	*Mangifera indica* L.	Anacardiaceae	Tha-yet	T
66	*Mikania micrantha* HBK	Asteraceae	Bizat-new, Yokekhama-shokehtwe	Cl, Cr
67	*Millingtonia hortensis* L. f.	Bignoniaceae	Ega-yit	T
68	*Mimosa pudica* L.	Mimosaceae	Hti-ka-yone	H
69	*Mimosa rubicaulis* Lam.	Mimosaceae	Biat-hli-ka-yone	H
70	*Mimusops elengi* L.	Sapotaceae	Khaye	T
71	*Morinda citrifolia* L.	Rubiaceae	Yeyo	ST
72	*Moringa oleifera* Lam.	Moringaceae	Dantalon	T
73	*Muntingia calabura* L.	Tiliaceae	Tha gya thi	ST
74	*Murraya paniculata* (L.) Jack	Rutaceae	Yuzana	ST
75	*Musa* sp.	Musaceae	Nget-pyaw	T
76	*Nauclea* sp.	Rubiaceae	Ma-u	T
77	*Operculina turpethum* (L.) Silva Manso	Convolvulaceae	Kyahin-bin	Cl, Cr
78	*Oroxylum indicum* (L.) Kurz	Bignoniaceae	Kyaung-sha	T
79	*Passiflora foetida* L.	Passifloraceae	Taw-suka	Cl
80	*Pennisetum pedicellatum* Trin.	Poaceae	Bottle-brush	G
81	*Phaulopsis parviflora* Willd	Acanthaceae	-	H
82	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Ye-chiya	S
83	*Phyllanthus urinaria* L.	Euphorbiaceae	Mye-zi-phyu	H
84	*Pithecellobium dulce* (Roxb) Benth.	Mimosaceae	Kala-magyi	T
85	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	Annonaceae	Ye-tama	T
86	*Polygonum* sp.	Polygonaceae	Kywe ngakhaung	S
87	*Psidium guajava* L.	Myrtaceae	Malaka	ST
88	*Pterocarpus indicus* Willd.	Fabaceae	Padauk	
88	*Pterocarpus indicus* Willd.	Fabaceae	Padauk	T
89	*Roystonea elata*	Arecaceae	Royal palm	T
90	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Kokko	T
91	*Scoparia dulcis* L.	Scorphulariaceae	Darna-thu-kha	H
92	*Senna siamea* (Lam.) Irwin & Barneby	Caesalpiniaceae	Mazali	T
93	*Sida acuta* Burm. f.	Malvaceae	Wet-chay-pane	S
94	*Streblus asper* Lour.	Moraceae	Okhne	T
95	*Swietenia macrophylla* King	Meliaceae	Mahogani	T
96	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Bizat-hpo	H
97	*Syngonium podophyllum* Schott	Araceae	-	H
98	*Tamarindus indica* L.	Caesalpiniaceae	Magyi	T
99	*Tecoma stans* (L.) H.B.K.	Bignoniaceae	Sein-tagyu	S
100	*Terminalia catappa* L.	Combretaceae	Banda	T
101	*Urena lobata* L.	Malvaceae	Katsene	S
102	*Vernonia cinerea* Less.	Asteraceae	Kadu-pyan	H

No.	Scientific Name	Family Name	Vernacular Name	Habit
103	*Wedelia biflora* (L.) DC.	Asteraceae	-	S
104	*Ziziphus jujuba* Lam.	Rhamnaceae	Zee	ST

(Habit)
T- Tree
ST- Small tree
S- Shrub
H- Herb
Cr- Creeper
Cl- Climber
G- Grass

Source: JICA Study Team

(b) Precious species : Vulnerable species

Within the survey area shown in Figure A1.1, the following two "vulnerable species" (tree) categorized in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List were found (Table A1.2):

- *Delonix regia* (Seinban/Flame tree).

- *Swietenia macrophylla* King (Mahogany tree).

Table A1.2 Two Vulnerable Species Found in theSurvey Area

Scientific Name	Family Name	Myanmar Name/ English Name	Habit	Global Threat Status
Delonix regia (Bojer ex Hook.) Raf.	Caesalpiniaceae	Seinban/Frame tree	Tree	Vulnerable species
Swietenia macrophylla King	Meliaceae	Mahogani/ Mahogany	Tree	Vulnerable species

Source: JICA Study Team

"Vulnerable species" are categorized as less threatened than "critically endangered species" or "endangered species" among the three types of threatened species in the IUCN Red List.

Flame trees and mahogany trees are found commonly in parks or green areas in the Yangon area.

After the planning area of new bridges and access roads was determined, a survey on the two abovementioned trees in the affected area was conducted. It was confirmed that these two species do not exist in the area.

(2) Animal species identified in the survey area (terrestrial and aquatic animals, benthos)

The number of animal species which were identified to exist in the survey area is as follows:
Amphibians: 2 Bird: 11 Butterfly: 10 Fish: 21 Reptile: 4 Benthos: 2
Animal species identified in the survey are shown in Table A1.3.
There was no record of important species in the tables such as species listed in the IUCN Red List.

Table A1.3 Animal Species Identified in the Survey Area of the Project

(a) Amphibians

No.	Scientific Name	Common Name	Family	IUCN, 2013	Source
1	*Bufo melanosticttus*	Common toad	Bufonidae	Least concern	Interview
2	*Kaloula pulchra*	Painted bull frog	Microhylidae	Least concern	Interview

Source: JICA Study Team

(b) Bird Species

No.	Scientific Name	Common Name	Family	Siting Place
1	*Spilopelia*	Spotted dove	Columbidae	Tree, shrub land, building
2	*Columba livia*	Rock pigeon		Grassland
3	*Apus nipalensis*	House swift	Apodidae	Aerial
4	*Halcyon*	White-throated	Alcedinidae	Mangrove
5	*Merops orientalis*	Green bee-eater	Meropidae	Mangrove
6	*Hirundo rustica*	Barn swallow	Hirundinidae	Aerial
7	*Pycnonotus blanfordi*	Streak-eared bulbul	Pycnonotidae	Mangrove
8	*Orthotomus sutorius*	Common tailorbird	Cisticolidae	Mangrove
9	*Acridotheres tristis*	Common myna	Sturnida	Ground
10	*Passer flaveolus*	Plain-backed sparrow	Passeridae	Shrubland
11	*Passer domesticus*	House sparrow		Ground,grassland

Source: JICA Study Team

(c) Butterfly Species

No	Scientific Name	Common Name	Family	Remark
1	*Euploea core godartii*	Crow	Danaidae	Common
2	*Danaus chrysippus*	Plain tiger	Danaidae	Very Common
3	*Ixias pyrene verna*	Whight orange tip	Pieridae	Common
4	*Catopsilia pyranthe*	Mottled emigrant	Pieridae	Common
5	*Catopsilia scylla*	Orange emigrant	Pieridae	Common
6	*Eurema hecabe*	Common grass yellow	Pieridae	Very Common
7	*Leptosia nina nina*	Psyche	Peridae	Common
8	*Cathosia cyane euanthes*	Leopard lacewing	Nyamphalidae	Common
9	*Hypolimnas misippus*	Danaid eggfly	Nyamphalidae	Common
10	*Argyronome laodice*	Pallas's fritillary	Nyamphalidae	Common

Source: JICA Study Team

(d) Fish Species

No.	Scientific Name	Common Name	Family	Remark
1	*Notopterus notopterus*	Grey featherback	Notopteridae	Observed
2	*Puntius spp*	Barb	Cyprinidae	Observed
3	*Amblypharyngodon mola*	Mola carplet	Cyprinidae	Observed
4	*Labeo calbasu*	Carp	Cyprinidae	Observed
5	*Cirrhinus mrigala*	Carp	Cyprinidae	Observed
6	*Clarias batrachus*	Walking catfish	Claridae	Observed
7	*Heteropneustes fossilis*	Stinging catfish	Heteropneustidae	Observed
8	*Mystus vittatus*	Catfish	Bagridae	Observed

9	*Mystus bleekeri*	Catfish	Bagridae	Observed
10	*Mystus leucophasis*	Catfish	Bagridae	Observed
11	*Channa orientalis*	Brown snakehead	Channidae	Observed
12	*Channa panaw*	Green snakehead	Channidae	Observed
13	*Macrognathus aral*	Lesser spiny eel	Mastacembelidae	Observed
14	*Macrognathus zebrinus*	Burmese spiny eel	Mastacembelidae	Observed
15	*Monopterus albus*	Asian swamp eel	Synbranchidae	Observed
16	*Monopterus cuchia*	Cuchia	Synbranchidae	Observed
17	*Oreochromic spp*	Mozambic cichlid	Cichlidae	Observed
18	*Boleophthalmus boddarti*	Boddart's goddle eye goby	Gobiidae	Observed
19	*Glossogobius giuris*	Gobifish	Gobiidae	Observed
20	*Polynemus paradiseus*	Mangoes fish	Polynemidae	Observed
21	*Cynoglossus lingua*	Long tonguesole	Cynoglossidae	Observed

Source: JICA Study Team

(e) Reptile Species

No.	Scientific Name	Common Name	Family	IUCN, 2009 CITES, 2009	Source
1	*Ptyas korros*	Indochinese rat snake	Colubridae	Least concern	Interview
2	*Eutropis carinatus*	Common skink	Scincidae	Least concern	Observed
3	*Calotes versicolor*	Garden fence lizard	Agamidae	Least concern	Observed
4	*Calotes emma*	Tree dwelling lizard	Agamidae	Least concern	Observed

Source: JICA Study Team

(f) Benthos Species (in the Pazundaung River)

No	Species	Common Name	Family	Status
1	*Scarteloas tenius*	Slender mudskipper	Gobiidae	Common
2	*Leptocarpus fluminicola*	Delta prawn	Palaemonidae	Common

Source: JICA Study Team

Appendix 1.2 Actual Measurements of Environmental Pollution

Measurement of ambient air quality (hereinafter called as “air quality”), ambient noise (hereinafter called as “noise”), water quality, sediment quality, and river flow rate are conducted in the project.

The aim of the measurement is to get data on the current conditions of these items, and to use such data as baseline data for environmental impact assessment.

(1) Air Quality

＜Measurement Points＞

There are five measurement points, as shown in Figure A1.2.

TAN-1 : Approximately midway of the north side of the approach road, at a distance of 50 m east of the existing road. Residences exist in the vicinity.

TAN-2 : At the place where the south side of the access road connects to the existing road, away from the road. Residences exist in the vicinity. (Symmetrical location with TAN-1).

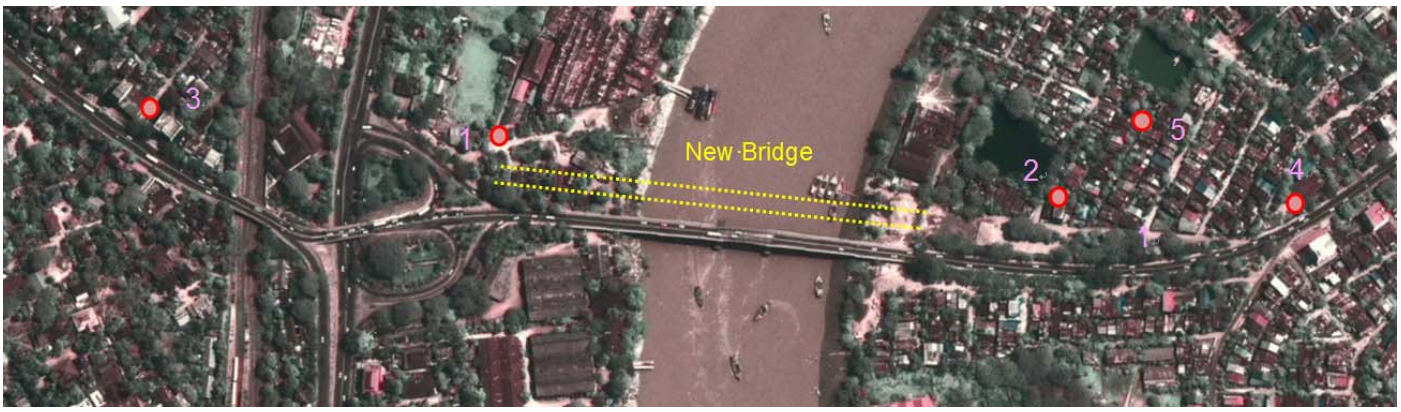
TAN-3：North side end of the approach road, roadside. There are many buildings such as residences in the vicinity.

TAN-4：Near the connection point with the south side of the access road and approach road, roadside.

TAN-5：(South side of the bridge, side of a pond) at a place hardly affected by roads, housing, and commercial activities.

Source: JICA Study Team

Figure A1.2 Measurement Points for Air Quality and Noise



＜Dates of Measurement＞

Dates of measurement are shown in Table A1.4 . Measurements were conducted for 24 hours at each point at a time.

Table A1.4Dates of Measurement of Air Quality

Point of the Survey	1st Measurement	2nd Measurement
TAN-1	19-20 November 2013	27-28 November 2013
TAN-2	14-15 November 2013	25-26 November 2013
TAN-3	20-21 November 2013	28-29 November 2013
TAN-4	14-15 November 2013	21-22 November 2013
TAN-5	18-19 November 2013	26-27 November 2013

Source: JICA Study Team

＜Results of Measurement＞

Table A1.5 to Table A1.8 show the results of the measurement of sulfur dioxide, carbon monoxide, nitrogen dioxide, particle matter 10 (PM_{10}), and particle matter 2.5 ($PM_{2.5}$).

All the result values are in terms of daily average.

Table A1.5 Measurement Results of Sulfur Dioxide (SO_2) (unit: ppm)

Measurement Point	TAN-1	TAN-2	TAN-3	TAN-4	TAN-5	Japan's Environmental Standards *	WHO Guidelines **
1st Measurement	0.03	0.01	0.02	0.02	0.02	Daily average less or equal to 0.04	Daily average less or equal to 0.04
2nd Measurement	0.02	0.01	0.02	0.02	0.03		

(Note) * : "Environment Standard for Air Pollution" (1973, Standard for $PM_{2.5}$: 2009)
** : WHO "Air Quality Guidelines – global update 2005"
Source: JICA Study Team

Table A1.6 Measurement Results of Carbon Monoxide (CO) (unit: ppm)

Measurement Point	TAN-1	TAN-2	TAN-3	TAN-4	TAN-5	Japan's Environmental Standards	WHO Guidelines
1st Measurement	0.4	0.7	0.4	0.4	0.5	Daily average less or equal to 10	—
2nd Measurement	0.4	0.7	0.5	0	0.4		

Source: JICA Study Team

Table A1.7 Measurement Results of Nitrogen Dioxide (NO_2) (unit: ppm)

Measurement Point	TAN-1	TAN-2	TAN-3	TAN-4	TAN-5	Japan's Environmental Standards	WHO Guidelines
1st Measurement	0.01	0.03	0.02	0.01	0.02	Daily average less or equal to 0.04～0.06 or less than that	Yearly average less or equal to 0.04
2nd Measurement	0.01	0.01	0.001	0.02	0.006		

Source: JICA Study Team

Table A1.8 Measurement Results of Particle Matter 10 (PM_{10}) (unit: ppm)

Measurement Point	TAN-1	TAN-2	TAN-3	TAN-4	TAN-5	Japan Environmental Standard	WHO Guidelines **
1st Measurement	0.04	0.1	0.07	0.08	0.04	Daily average less or equal to 0.10	Daily average less or equal to 0.05
2nd Measurement	0.06	0.06	0.06	0.06	0.08		

Source: JICA Study Team

Table A1.9 Measurement Results of Particle Matter 2.5 (PM2.5) (unit: $\mu g/m^3$)

Measurement Point	TAN-1	TAN-2	TAN-3	TAN-4	TAN-5	Japan Environmental Standard	WHO Guidelines **
1st Measurement	4	3	4	5	5	Daily average less or equal to 35	Daily average less or equal to 25
2nd Measurement	6	5	4	4	6		

Source: JICA Study Team

The results at all the measurement points were within the range of Japan's environmental standards, and the standards in the World Health Organization (WHO) Guidelines.

(2) Noise

＜Measurement Points＞

Measurement points are the same five points as for air quality.

＜Dates of Measurement＞

The dates of measurement are shown in Table A1.10. Measurements were conducted for 24 hours at each point,at a time.

Table A1.10 Period of Measurement of Noise

Point of the Survey	1st Measurement	2nd Measurement
TAN-1	20-21 November 2013	28-29 November 2013
TAN-2	15-16 November 2013	26-27 November 2013
TAN-3	21-22 November 2013	29-30 November 2013
TAN-4	15-16 November 2013	22-23 November 2013
TAN-5	19-20 November 2013	27-28 November 2013

Source: JICA Study Team

＜Results of Measurement＞

Table A1.11 shows the results of measurement of noise.

Table A1.11 Measurement Results of Noise

Time of Measurement	TAN-1		TAN-2		TAN-3		TAN-4		TAN-5		Japan's Environmental Standards *	WHO Guidelines**
	1st Measurement	2nd Measurement	1st Measurement	2nd Measurement	1st Measurement	2nd Measurement	1st Measurement	2nd Measurement	1st Measurement	2nd Measurement	Daytime/ Nighttime	24 hours
Daytime 6:00 a.m. – 10:00 p.m.	58	56	65	62	60	63	60	60	54	55	less or equal to 65 dB	70 dB
Nighttime 10:00 p.m. – 6:00 a.m.	56	51	58	52	45	56	51	53	40	45	less or equal to 60 dB	

(Note) * : "Standard of Ambient Noise" (1998)
- Category of Area: Area C (Area to be used for commercial use, industrial use, etc., together with a considerable number of residences)
- Division of time : Daytime 6:00 a.m.–10:00 p.m., and nighttime 10:00 p.m.– 6:00 a.m.
- Division of area: Area facing the road with lanes within Area C

** : WHO "Guideline values for community noise in specific environment" (1999)
- Industrial area, commercial area, roadside, indoor /outdoor

Source: JICA Sudy Team

The results at all the measurement points were within the range of Japan's environmental standards, and the standards in the WHO Guidelines.

(3) Water Quality, Sediment Quality, and River Flow Rate

＜Measurement Points＞

The measurement points are shown in Figure A1.3.

Source: JICA Study Team

Figure A1.3 Measurement Points for Water Quality, Sediment Quality, and River Flow Rate

TSW-1 (Water Quality, Sediment Quality)	TRV-1 (River Velocity)
	TRV-2 (River Velocity)
TSW-2 (Water Quality, Sediment Quality)	TRV-3 (River Velocity)
TSW-3 (Water Quality, Sediment Quality)	TRV-4 (River Velocity)
	TRV-5 (River Velocity)
TSW-4 (Water Quality, Sediment Quality)	TRV-6 (River Velocity)

＜Date of the Survey＞

Measurement and sampling were conducted on 7 November 2013.

＜Results of the Measurement＞

(a) Water Quality

Table A1.12 (1) and Table A1.12 (2) show the results of water quality measurement.

Table A1.12 (1) Results of the Water Quality Measurement－Points TSW-1 and TSW-2

Parameter	Unit	TSW-1		TSW-2		Japan's River Water Quality Standards for Public Usage* Category D**
		Surface Layer	Bottom Layer	Surface Layer	Bottom Layer	
River Depth	m	12.9		8.1		
Depth of Sampling (Under Surface)	m	0.5	11.5	0.5	6.5	
Water Temperature	℃	28.27	28.24	28.38	28.35	
Salinity	%	ND	ND	ND	ND	
Turbidity	FNU	645	684	623	809	
Suspended Solids(SS)	mg/L	78	65	67	66	100<
pH	mg/L	7.74	7.67	7.67	7.07	6.5～8.5
Dissolved Oxygen(DO)	mg/L	3.89	3.65	3.71	3.60	>2
BOD_5	mg/L	2.5	1.5	2.0	2.5	8<
COD	mg/L	3.47	2.36	2.20	3.31	
Oil and Grease	mg/L	<1.0	<1.0	<1.0	<1.0	
E. Coli	MPN/100 mL	0	$4x10^2$	0	0	
Total Coliform	MPN/100 mL	$7x10^2$	$3.6x10^3$	$6x10^3$	$2.4x10^4$	
Total Nitrogen	MPN/100 mL	$7x10^2$	$4x10^3$	$6x10^3$	$2.4x10^4$	
Total Phosphorous	mg/L	2.016	UDL	1.340	UDL	
Total Nitrogen	mg/L	0.036	0.040	0.040	0.330	

(Note) * : "Environmental Standard for Water Pollution"
#2 Water quality standard for conservation of living environment (1971)
** Category D : Industrial Water Grade 2 (special water purification is operated), Agricultural Water and Conservation of Environment

Source: JICA Study Team

Table A1.12 (2) Results of the Water Quality Measurement－Points TSW-3 andTSW-4

Parameter	Unit	TSW-3		TSW-4		Japan's River Water Quality Standards for Public Usage* Category D**
		Surface Layer	Bottom Layer	Surface Layer	Bottom Layer	
River Depth	m	12.9		5.2		
Depth of Sampling (Under Surface)	m	0.5	10.0	0.5	4.0	
Water Temperature	℃	28.44	28.42	28.63	28.60	
Salinity	%	ND	ND	ND	ND	
Turbidity	FNU	616	693	608	845	
Suspended Solids(SS)	mg/L	62	61	63	61	100<
pH	mg/L	7.7	7.14	7.78	7.29	6.0～8.5
Dissolved Oxygen(DO)	mg/L	3.63	3.60	3.45	3.43	>2
BOD_5	mg/L	2.0	1.5	2.0	1.0	8<
COD	mg/L	6.99	2.36	2.73	2.46	
Oil and Grease	mg/L	<1.0	<1.0	<1.0	<1.0	

Parameter	Unit	TSW-3		TSW-4		Japan's River Water Quality Standards for Public Usage* Category D**
		Surface Layer	Bottom Layer	Surface Layer	Bottom Layer	
E. Coli	MPN/100 mL	0	$2x10^2$	0	0	
Total Coliform	MPN/100 mL	$3x10^3$	$5x10^3$	$2x10^3$	$4x10^2$	
Total Nitrogen	MPN/100 mL	$3x10^3$	$5.2x10^3$	$2x10^3$	$4x10^2$	
Total Phosphorous	mg/L	2.016	3.36	0.672	0.672	
Total Nitrogen	mg/L	0.33	0.33	0.40	0.33	

Source: JICA Study Team

The features of water pollution of Pazundaung Creek near Thaketa Bridge are as follows:

-The measurement values of suspended solids (SS), pH, dissolved oxygen (DO), biochemical oxygen demand (BOD_5) were within the range of Category D of Japan's environmental standards for river water quality.

-The first feature of the water quality in Pazundaung Creek near Thaketa Bridge is that the concentration level of suspended solids is high. The suspended solids have two origins. One is flowing down from the upstream of wide water basin, and the other is flowing from the discharge of living drainage from urban activities. Because the concentration of BOD_5 is relatively low, it is assumed that the ratio of the former is higher.

Because there is no fishing activity in the river around the project site, it is possible that river usage is deemed equivalent to Category D of the Japanese standard, and water quality of the river is evaluated referring to the values in the standard.

(g) Sediment Quality

Table A1.13 shows the results of the measurement of sediment quality.

According to the results of the measurement, there is no sediment quality item whose concentration has particular problem.

Table A1.13 Results of Measurement of Sediment Quality

Item	Point of Sampling				Unit
	TSD-1	TSD-2	TSD-3	TSD-4	
Color	Dark grey	Dark grey	Dark grey	Dark grey	
Odor	Muddy	Muddy	Muddy	Muddy	
Mercury (Hg)	0.002	0.004	0.003	0.003	mg/kg
Arsenic (As)	0.002	0.0047	ND	ND	
Lead (Pb)	130	135	120	125	ppm
Chromium (Cr)	12	10	15	13	ppm
Cadmium (Cd)	0.009	0.008	0.005	0.005	ppm
Copper (Cu)	75	80	87	90	ppm
Zinc (Zn)	90	105	110	95	ppm
Natural Moisture Content	84.06	40.87	60.75	40.03	%

Item	Point of Sampling				Unit
	TSD-1	TSD-2	TSD-3	TSD-4	
Specific Gravity	2.68	2.62	2.67	2.63	-
TOC	91.20	61.90	57.31	39.00	mg/kg
Oil and Grease	<100	<100	<100	<100	mg/kg

Source: JICA Study Team

(h) River Velocity and Flow Rate

From the measurements of water depth of river crossing direction and velocity, the river flow is calculated as follows:

Flow rate immediately upstream = 249 m^3/s

Flow rate 200 m downstream of the bridge = 202 m^3/s

Appendix 1.3 Social Environment

(1) Population and Household

Yangon City has experienced rapid population growth in recent years. The average growth rate of the population in Yangon City between 1998 and 2011 was 2.58% annually.

The population and number of households of two townships where the project site is located (hereinafter referred to as "the two townships") are shown in Table A1.14 .

The population growth rate of Mingalar Taung Nyunt Township (1998-2011) was 2%, as well as Yangon, but Dawbon Township was less than 1%.

Table A1.14 Population and Number of Households of the Two Townships

Township	Population		Annual average growth rate of population 1998～2011	Number of households 2011	Number of people per household 2011	Area (ha)	Population density (thousand/ km^2) 2011
	1998	2011					
Mingalar Taung Nyunt	109,796	155,767	2.73%	22,732	6.9	494	315
Dawbon	79,582	87,284	0.71%	13,603	6.4	311	281
Greater Yangon	3,691,941	5,572,242	2.58%	919,835	6.1	153,489	36

Source : SUDP (The Project for The Strategic Urban Development Plan of the Greater Yangon) (Aug. 2012 – Dec. 2013) Final Report

(2) Race and Religion

Table A1.15 shows the population percentage of the three main ethnic groups in the two townships.

The percentage of Bamar or Burman in the two townships is very large.

Table A1.15 Main Ethnicity in the Two Townships (2011)

Township	Population percentage of the three main ethnic groups in the two townships (%)		
	Bamar	Rakhine	Kayin
Mingalar Taung Nyunt	93.1	1.5	0.0
Dawbon	80.1	1.3	0.3

Source: SUDP Final Report (Annex: Township Data Sheet)

(3) Industries and Labor Force

Table A1.16 shows the labor force in the two townships, while Table A1.17 shows the number of factories and workshops in the two townships.

The number of factories and workshops per capita of Mingalar Taung Nyunt Township is almost twice as that of Dawbon Township.

Table A1.16 Labor Force in the Two Townships (2011)

Township	Population	Primary Industry	Secondary Industry	Tertiary Industry	Extempore	Total Workers	Working Population Ratio
Mingalar Taung Nyunt	155,767	0	2,158	87,997	23,892	114,047	73.2 %
Dawbon	87,284	126	1,894	32,302	27,469	61,792	70.8%
Yangon City Total	5,142,128	42,674	190,062	1,778,298	600,062	2,611,977	50.8%

Source: SUDP Final Report (2013)

Table A1.17 Number of Factories and Workshops of the Two Townships (2010-2011)

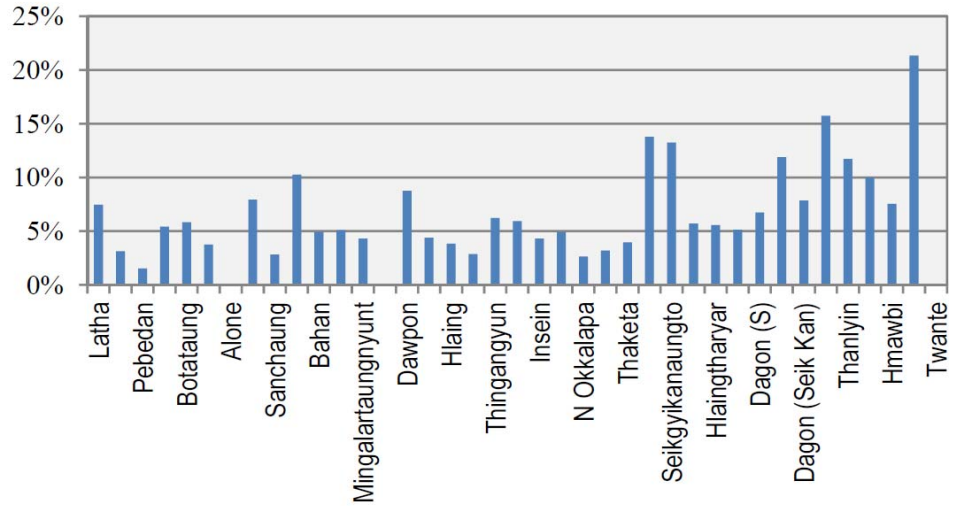
Township	Number of Factories and Workshops	Population (2011)	Area (km^2)	Number of Factory and Workshop per 1000 Population	Number of Factory and Workshop per Area (/km^2)
Mingalar Taung Nyunt	340	155,767	4.94	2.2	69
Dawbon	117	87,284	3.11	1.3	38
Greater Yangon	13,582	5,142,128	828.96	2.6	16

Source: SUDP Final Report (2013)

(4) Poor People

In the study of SUDP, the poverty line, which was used to identify poor against non-poor, was defined as earning USD 3 per day (equivalent with 75,000 MMK per month). This amount is the minimum of subsistence food plus non-food consumption based on the project entitled “Integrated Household Living Conditions Survey in Myanmar (2009-2010)” by the United Nations Development Programme (UNDP). Based on the household interview survey (HIS) of the SUDP study, the distribution of households below the poverty line by township is shown in Figure A1.4 .

The proportion of households below the poverty line in Mingalar Taung Nyunt Township is about 4% and Dawbon Township is about 9%. Dawbon Township has a higher degree of poverty than Mingalar Taung Nyunt Township.



Source: SUDP Final Report (2013) (Estimation based on Household Interview Survey)

Figure A1.4 Households Ratio Below the Poverty Line by Township

(5)Land Use

Table A1.18 shows the percentage of land use in the two townships.

Compared with Mingala Taung Nyunt Township, the percentage of residential and open space areas are larger in Dawbon Township. On the other hand, the proportion of public facilities to land is very small in Dawbon Township.

Table A1.18 Percentage of Land Use in the Two Townships (%)

Township	Residential Area	Community and Business Area	Industrial Area	Public Facilities	Under Developing Area	Playground	Agricultural Area	Open Space	Green Area	Water Surface
Mingala Taung Nyunt	53	3	13	14	1	3	0	2	8	3
Dawbon	66	2	10	1	0	0	0	16	0	5

Source: SUDP Final Report (Annex: Township Data Sheet)

(6) Infrastructure and Social Services

(a) Electricity

The Yangon City Electricity Supply Board (YESB) of the Ministry of Electric Power II (MOEP-2) is in charge of the power distribution in Yangon City, including the project site.

Power distribution rates of Mingalar Taung Nyunt Township and Dawbon Township were 100% and 97%, respectively (estimation was based on Household Interview Survey, 2012), while power distribution amounted to 25,000 kW and 5,000 kW, respectively.

(b) Water Supply and Sewage

With regard to the rate of piped water supply of the two townships, Mingalar Taung Nyunt is at 90.7% and Dawbon is at 46.0% while the development of sewage treatment in Mingalar Taung Nyunt is at 78.5% and Dawbon is at 43.8%.

The rates of toilet facilities of Mingalar Taung Nyunt is 98.9% and Dawbon is 100.0%.

(c) Medical, Health, and Sanitation

Private clinics have only the minimum required medical equipment.

Township hospitals provide health care services including laboratory, dental, and major surgical procedures.

More advanced medical care is provided in regional scale hospitals, or in central or university hospitals with the latest medical equipment.

Table A1.19 shows the public medical/health facilities by type in the two townships (2012).

Table A1.19 Medical/Health Facilities by Type in the Two Townships (2012)

Township	Central Level Hospital	Above 25-Bedded Hospitals	Rural Health Center (Sub)	School Health Center	Maternity and Child Health Center	Total	Number of Doctors /10000 Population
Mingalar Taung Nyunt	0	0	0	1	0	1	0.45
Dawbon	0	0	1	0	0	1	0.34

Source: JICA Study Team (based on data from the Department of Health, Ministry of Health)

Table A1.20 shows the private health care services in the two townships.

Table A1.20 Private Health Care Services in the Two Townships (2012)

Township	General Clinics	Specialist Clinics	General Hospitals	Specialist Hospitals	Total
Mingalar Taung Nyunt	79	8	0	0	87
Dawbon	51	0	1	0	52

Source: JICA Study Team (based on data from the Department of Health, Ministry of Health)

The number of beds per 10,000 people in Mingalar Taung Nyunt Township is 0.45, and in Dawbon Township is 0.34. Those values are at a very low level compared with the 1.90 of the Greater Yangon area. Medical facilities in the two townships are insufficient as shown above. Medical care is dependent on other townships in Yangon City.

(d) Education

At present, the basic education structure in Myanmar consists of five years of primary school education, four years of middle school education, and two years of high school education. In this structure, kindergarten is taken to be part of the primary education cycle. In fact, it constitutes the first

year of the primary school. In effect, a child receives 11 years of schooling (kindergarten and Grades I-X) before entering higher education. The 11 years of basic education culminate in the matriculation examination, which is conducted annually on a nationwide scale and administered by the Myanmar government. Students who pass the matriculation examination are eligible to enter any university or institute according to their choice and total examination score.

All schools in Myanmar are government-operated. The existing Private Tuition Law of 1984 does not allow a private school to operate without following the basic education curriculum.

Table A1.21 shows the number of educational facilities in the two townships.

Table A1.21 Number of Educational Facilities in the Two Townships

Township	Number of Schools, Number of Students							
	Primary School		Middle School		High School		University/Collage	
	Number	Students	Number	Student	Numbe	Student	Number	Student
Mingalar Taung Nyunt	22	6,603	2	4,247	6	1,700	0	0
Dawbon	12	3,769	4	3,224	1	1,801	0	0

Source: Department of Basic Education, 2012

(7) Historical Buildings

Yangon is a city with a long history. There are 189 buildings designated as historical buildings in Yangon (Table A1.22).

With regard to religious buildings, 29 historic buildings were identified having Buddhism relationship, including the Shwedagon Pagoda. In addition, since various ethnic groups have been living through the development process of Yangon, various religious architectures are in place. The total number of religious buildings is 92 (including 22 buildings of Christianity, Hindu, and religious facilities of Chinese other than Buddhism).

In terms of non-religious facilities, there are many luxurious buildings constructed for administrative bodies during the British rule era.

Table A1.22 Heritage Buildings in Yangon City (1996)

Admin/ Institution (Offices, medical centers, etc.)	Social Building (Schools, hospitals, etc.)	Commercial Building (Hotels, markets, etc.)	Residential	Religious Building	Total
52	39	3	3	92	189

Source: Edited from the YCDC Heritage Buildings List

Table A1.23 shows the number of religious facilities in the two townships.

Table A1.23 Number of Religious Facilities in the TwoTownships (2011)

Township	Pagoda	Monastery	Church	Mosque	Hindu Temple	Chinese Temple
Mingalar Taung Nyunt	11	69	5	14	25	2
Dawbon	10	35	1	1	9	0

Sources: JICA Study Team (based on the data from TCDC)

(8) Traffic Accidents

Table A1.24 shows the number of traffic accidents in the two townships.

Table A1.24 Number of Traffic Accidents in the Two Townships (2011)

Township Mingalar Taung Nyunt	Number of Traffic Accidents in 2011			Traffic Accidents per 10,000 Population	Traffic Accidents per mile^2
	Number of Death	Number of Injuries	Total		
Mingalar Taung Nyunt	2	37	39	2.50	19.9
Dawbon	2	25	27	3.09	18.4
Greater Yangon	208	1,830	2,038	3.24	6.6

Source: JICA Study Team (based on the data from the Traffic Police, Ministry of Home Affairs)

Appendix 1.4 Outline of the Environmental Impact Assessment (EIA) Procedures (Draft)

(1) EIA Procedures (draft)

With regard to the procedures of EIA, the **Ministry of Environmental Conservation and Forestry** (MOECAF) has been working on the preparation of the "Environmental Conservation Rules". The draft of EIA procedures (hereafter referred to as " EIA Procedures (draft)") was created in 2012. As of January 2014, the EIA Procedures (draft) are still in the draft stage and waiting for further brushing up and official enactment.

The outline of the EIA Procedures (draft) is shown in Table A1.25.

Table A1.25 Outline of the EIA Procedures (Draft)

Chapter/Article	Major Points
I Title and Definition	
Article 1	The procedure is called the EIA Rule.
Article 2	Definition of the expressions in the EIA Rule.
II Establishment of Environmental Impact Assessment Process	
Article 3	Any project or business or activity undertaken in Myanmar by any ministry, government department, organization, corporation, local government, which likely to have significant impact on environment, is required to undertake EIA.
Article 4	MOECAF is the executive agency in charge of the EIA Rule.
	An EIA committee shall be established. The committee will give environmental approval with the recommendation of MOECAF.
	Any projects which require IEE or EIA shall not be issued a permit by the MIC or any relevant authority without written approval of MOECAF.
	For projects involving facilities which already exist or under construction, the owner will undertake environmental/social compliance audit to identify concerns related to impacts on involuntary resettlement and indigenous peoples, and take appropriate actions.
Article 5	a) The powers and functions of MOECAF under the EIA Rule are as follows: (1) To identify project screening criteria; (2) To approve guidelines for IEE or EIA; (3) To review and approve IEE/EIA report; (4) To evaluate the environmental management plan (EMP); (5) To monitor and enforce implementation of the EMP; and (6) Others.
	b) The functions and duties of the EIA committee under the EIA Rule are: (1) To recommend approval of project screening criteria to MOECAF; (2) To recommend approval of IEE/EIA report to MOECAF; and (3) To recommend approval of the EMP to MOECAF.
Article 6	MOECAF shall arrange, as it deems necessary, for public participation of civil society and relevant agencies in the conduct of IEE/EIA and in the implementation of EMP.
III Screening	
Article 7	The project shall present the project proposal for screening of MOECAF.
Article 8	Schedules I and II are defined as the criteria for the conduct of IEE/EIA.
Article 9	Schedule III is also defined as sensitive areas where no project shall be conducted.
IV Scoping	
Article 12	All proponents of the projects that are required to carry out a full EIA, either by virtue of Schedules II or III or by order of the MOECAF shall conduct scoping process.
V Investigation	
Article 13	Project proponent shall carry out a full analysis and investigation of all the potential environmental impacts, both adverse and beneficial impacts of the proposed project.
VI Reporting, Review and Approval	
Article 14	Project proponent required to carry out EIA shall prepare EIA report in the format defined by MOECAF.
Article 15	Upon receipt of the IEE/EIA report including EMP, MOECAF shall invite the relevant agencies, institutions, civil society organizations, and project-affected persons to provide comments and suggestions in the report.
Article 16	MOECAF shall approve or refuse the IEE/EIA report as a basis for environmental clearance on the recommendation of EIA Committee.
VII Monitoring	
Article 18	MOECAF shall carry out monitoring of the implementation of the approved EMP by the project proponent.

Source: Compiled from the Environmental Impact Assessment Procedures (Draft)

Table A1.26 shows the list of IEE/EIA required in the transport project of infrastructure development.

Table A1.26 List of IEE/EIA Required in the Transport Project for Infrastructure Development

Purpose and Type of Project	Project Feature (size, etc.)
(I) IEE Required Project (Schedule I)	
1) River Training Works	All projects
2) Construction of Bridges	More than 50 ft and less than 200 ft
3) Port Development	All projects
(II) EIA (full EIA) Required Project (Schedule II)	
1) Construction of Highways and fly-over	All projects if recommended by IEE
2) Ports Development	All projects if recommended by IEE
3) Construction of Subways	All projects if recommended by IEE
4) Construction of Bridges	More than 200 ft
5) Construction of Shipyards	Dead weight tonnages greater than 5,000 t
6) Construction of Airports	Airstrips of 8,200 ft (2,500 m) or longer
7) Construction of Railways including Construction of New Routes	All projects if recommended by IEE

Note: Project activities other than new construction such as rehabilitation, extension and/or improvement are not clearly stipulated.
Source: Compiled from the Environmental Impact Assessment Procedures (Draft, 2013)

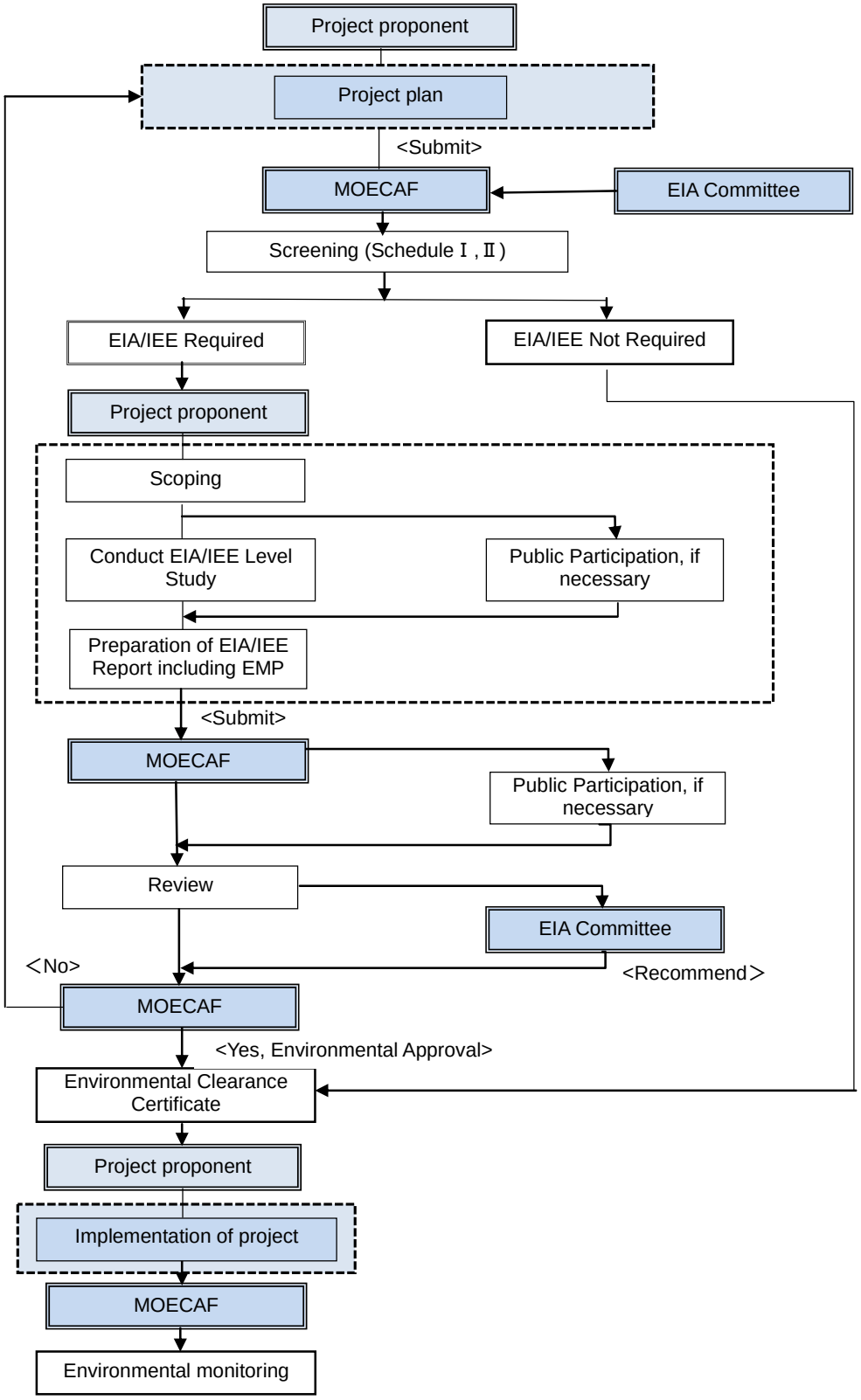
Table A1.27 shows the environmentally, ecologically, and sociocultural sensitive areas (Schedule III).

Table A1.27 Environmentally, Ecologically and Sociocultural Sensitive Areas (Schedule III)

No.	Sensitive Areas
1	Areas of unique historical, cultural, archaeological, scientific, or geographical significance
2	Wetlands
3	Ecologically fragile area
4	National parks, wildlife sanctuaries, and protected areas
5	Wilderness areas containing rare or endangered species of flora or fauna and their habitat
6	Areas susceptible to natural hazards
7	Major sources of public drinking water
8	Areas surrounding lakes and reservoirs
9	Resort areas and areas closed to oyster fishing and pearl farm areas
10	Flooded or flood plains on other or other hazardous zones

Source: JICA Study Team

The schematic processes of environmental approval in the EIA Procedure is shown in Figure A1.5.



Note : MOECAF – Ministry of Environmental Conservation and Forestry

Source : Environmental Impact Assessment Procedures (Draft, 2013)

Figure A1.5 Schematic Process for Environmental Approval

Appendix 1.5 Organization Relating to Environmental Conservation in Myanmar

In Myanmar, there have been a department under the National Commissions for Environmental Affairs (NCEA) in the Ministry of Forestry, but the scope of work was limited to parts of environment-related activities. The Ministry of Forestry was reorganized in September 2011, adding jurisdiction on the environment. With this, MOECAF was established as the organization having comprehensive jurisdiction on environmental issues.

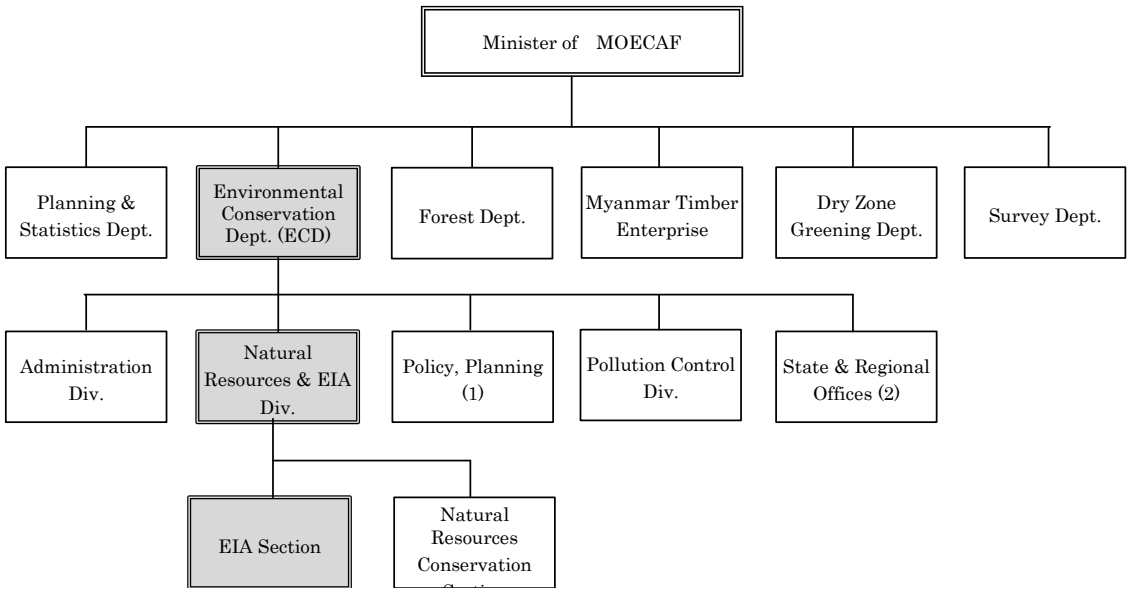
Among them, the EIA Section has the following duties and responsibilities:

- To develop EIA procedures and regulations to avoid, minimize, and/or mitigate adverse environmental impacts,

- To monitor the implementation of environmental conservation, and

- To review EIA reports for development projects.

Figure A1.6 shows the organizational chart of MOECAF.



Note: (1) Policy, Planning and International Relations, Research and Extension Division
(2) State and Regional Offices (Yangon, Mandalay, Sagaing, Bago, Taninthari)
Source: Edited from documents of MOECAF

Figure A1.6 Organizational Chart of MOECAF

Appendix 1.6 Comparative Consideration of Alternatives

Three alternatives including the zero option (Table A1.28) were comparatively considered for the project.

The alternatives were compared in terms of economic efficiency, engineering, environmental and social considerations, and matching to YUTRA (project implementation effect).

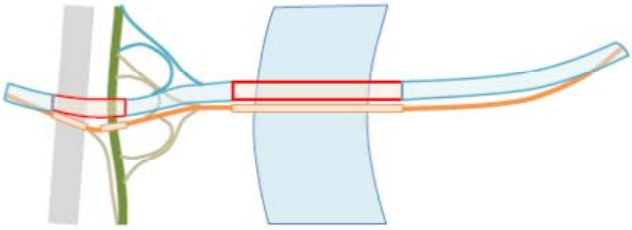
Comprehensive evaluation was implemented and the current plan was selected as the project target plan.

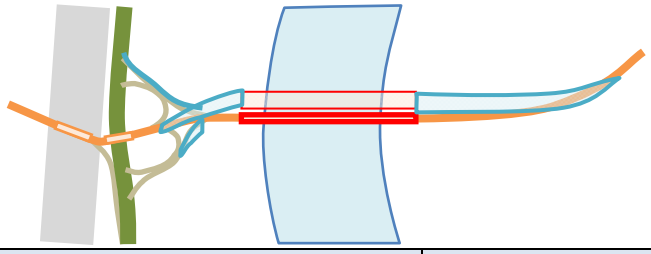
Table A1.28 Comparative Consideration of Alternatives

<table>
<tr><th>Alternatives</th><th colspan="2">Description</th><th>Evaluation</th></tr>
<tr><td rowspan="3">Alternative 1
(Zero Option)

Construction of Bridge and related roads are not conducted.</td><td colspan="2">- Continuous use of the existing bridge and roads
-The area around the bridge is assumed that bridge is one of the strategic points of the transportation of Yangon City. Roads disorder and traffic congestion will increase in the future in the continuous use of the existing bridge and roads. Because 47 years have passed since the completion of construction of this bridge, deflection, vibration due to aging have occurred.</td><td>Since the situations in the description cause metal fatigue, which may lead to the collapse risk of the bridge or breaking of some parts., this alternative was not selected</td></tr>
<tr><td>Structures Replacement and Resettlement</td><td colspan="2">Effect of the development</td></tr>
<tr><td>-No environmental and social impact occurs for construction of bridge and associated road.</td><td colspan="2">This alternative do not eliminate the serious traffic bottleneck in the area.</td></tr>
<tr><td rowspan="3">Alternative 2

-Four-lane new bridge is constructed in upper stream of the existing bridge.

-Approach road is connected almost straightly/linearly from the bridge end to Set Yone road.</td><td colspan="2">  </td><td>Since number of persons to be resettled is large, this alternative was not selected.</td></tr>
<tr><td>Structures Replacement and Resettlement</td><td colspan="2">Effect of the development</td></tr>
<tr><td>-Number of persons to be resettled are large (about 190)
-A Hindu temple is affected.</td><td colspan="2">-Serious traffic bottleneck problem of current bridge area can be fundamentally solved by full four-lane bridge and roads system</td></tr>
<tr><td rowspan="3">Alternative 3
(Grant Aid Scope)
- Four-lane new bridge is constructed in upper stream of the existing bridge, and connected to existing road at shortest distance.

(Myanmar Side Scope)
- Approach road is expanded to four-lane
- Demolition of existing bridge
- Reconstruction of railway fly-over and road fly-over</td><td colspan="2">  </td><td>This is ideal plan. Since the number of persons to be resettled is significantly smaller than the alternatives 2. This alternative was selected.</td></tr>
<tr><td>Structures Replacement and Resettlement</td><td colspan="2">Effect of the development</td></tr>
<tr><td>-Number of persons to be relocated is smaller than alternative 2 (about 7 shops/workshops)
-A Hindu temple is not affected.</td><td colspan="2">-Serious traffic bottleneck problem of current bridge can be fundamentally solved by full four-lane bridge and roads system, nearly equivalent to alternative 2.</td></tr>
</table>

Source: JICA (Japanese International Cooperation Agency) Study Team

Appendix 1.7 Scoping

In the stage before the field survey, expected impacts were assessed and summarized in the scoping with evaluation on the extent of the impacts and reasons .

Table A1.29 shows the results of the scoping.

Table A1.29 Results of the Scoping

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage Ⅰ/Ⅱ	Stage Ⅲ	
Socal Environment	1	Land acquisition and involuntary resettlement	B-		<Planning Stage> -There is a possibility of involuntary resettlement of employees of two automobile repair workshops in the north side of the bridge and one shop in the south side of the bridge -There is a possibility of involuntary resettlement of one household in the south side of the bridge. -Several structures (workshops, shops) in the north and south side of the bridge are necessary to be relocated. -On both sides of the creek, removal or transplanting and/or alternative planting of a considerable number of trees (in public land) is expected to be required. -Lands to be required for the project are all publicly owned. Acquisition of private land is not needed.
				D	No impact is expected.
	2	Poor people	C		<Planning Stage> In the existing information, residents in the project site are people related to PW, automobile repair workshops or shops, and there are no poor people therein. However, that is confirmed by the survey.
				B+	By the new road and improved access roads, even the poor are expected to access social services such as schools, hospitals, markets, etc. easily.
	3	Indigenous people or ethnic minority	D	D	Neither indigenous people nor ethnic minority group is found in the project area.
	4	Local economy such as employment and livelihood, etc.	C+		<Construction Stage> Beneficial impacts such as creation of employment opportunity for construction works, will be expected even temporarily.
				B+	By the project, traffic access will be upgraded and existing traffic congestion will be eliminated. Since transportation and logistics situation is improved, positive effect can be expected according to the improvement of local economy.
	5	Utilization of land and local resources	C		<Construction Stage> Stone, gravel, and soil used for construction are expected not coming from the project site, but from a location far away from the project site. However, that is will be confirmed by the plan of construction.
				D	Impact is not expected because agriculture and forestry are not performed in and around the project site.
	6	Water usage	D		<Construction Stage> -There may be no effect on regional water use since water for construction is generally supplied and brought in (for drinking, etc.) the area. -Since there is no water use on the surface and body of the creek, any impact on water use is not expected.
				D	Impact is not expected
	7	Existing social infrastructures and services	B-		<Construction Stage> -The current bridge is present during the new bridge construction, there is no permanent closure of the existing bridge and roads. However, due to transportation of construction material/ equipment and construction waste, temporal and partial closure of roads, traffic control, etc. may occur. Therefore, there is a possibility of some inconvenience such as temporal traffic congestion and reduction of accessibility to public facilities. -Since there is a possibility that facilities and lines of social

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage I / II	Stage III	
					infrastructure (electricity, telecommunications, water and sewerage, etc.) exist on the ground and underground of the planned area of access roads. Confirmation is necessary with the related agency.
				B+	Transportation infrastructure is improved by the project and access to social service facilities in the region is improved.
	8	Social institutions such as social infrastructure and local decision making institutions	D	D	As the project is the construction of the bridge and access roads, there is almost no impact on the social institutions such as decision making.
	9	Misdistribution of benefit and damage	C-	C-	It is expected that there is almost no possibility of misdistribution of benefits and damages through the execution of the project. However, with regard to the impact by, for example, operation of transportation vehicles and heavy machines during construction, if the explanation to the residents and the local authorities is insufficient, misdistribution of benefits and damage is possible to occur.
	10	Local conflict of interests	D	D	The project is a new bridge construction, thus, by itself will not cause a conflict of interest in the region.
	11	Cultural, historical, archaeological and religious heritage sites	D	D	In the project site, there are no valuable cultural, historical, archaeological structures and religious heritage sites.
	12	Water rights, fishing rights, and rights of common	C	C	-Water rights and fishing rights are seemed not set on the river around the project area. However, that is confirmed by the survey. -No rights of common in the peripheral forest around the project site is established. -Since the bank area of the river in and around the project site is a controlled area of the MPA, it is necessary to obtain permission to MPA for use of land.
	13	Landscape	D		<Construction Stage> Current state landscape may be impaired during construction. However that is temporary and partial.
				C-	Since the existing bridge and new bridge stand side by side for a temporary period, there is a possibility of harmonizing the new and old bridges, which may affect the landscape of the entire area.
	14	Gender	D	D	No particular impact is expected.
	15	Rights of children	B-	B-	The planned area of access roads includes part of the park in Dawbon side. In this park, children play sports or play with playground equipment. Therefore, the impact is expected to occur.
	16	Public health and sanitation	B-		<Construction Stage> Though the impact is temporary, air pollutants such as dust, SPM, NOx, SOx emitted from construction vehicles and construction heavy machines/works may cause some adverse effect to respiratory organs.
				C-	There is a slight possibility that air pollution due to increase in traffic volume may cause some adverse effect to respiratory organs.
	17	Infectious	B-		<Construction Stage>

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage I / II	Stage III	
		diseases such as HIV/AIDS			Construction workers and truck drivers are considered as potential for the spread of infectious diseases such as HIV/AIDS by contacting with local women.
				D	No impact is expected.
	18	Working condition (including occupational health)	C-		<Construction Stage> There is a possibility that the health and occupational safety of the workers may be jeopardized depending on the conditions.
				D	No impact is expected.
	19	Accidents	B-		<Construction Stage> -It is expected that accidents occur due to construction vehicles, heavy machines and traffic congestion. -There is a possibility of an accident on the creek due to transportation vessels.
				C-	There is a possibility of an increase in traffic accidents due to increase in traffic volume and speed.
	20	Global warming/ climate change	D		<Construction Stage> Generation of greenhouse gases is expected due to construction vehicles/vessels and heavy machines. However, extent of impact on climate change and cross-border are expected to be negligibly small.
				D	Increase in emission of greenhouse gases is expected due to increase in traffic volume. However, extent of impact is expected to be negligibly small.
	21	Electromagnetic interference	C-	C-	Depending on the elevated structure of bridge road structure may cause slight electromagnetic interference. However, affected residences and buildings are little around the planned area.
Natural Environment	22	Protected Area	D	D	There are no sensitive areas and/or protected areas in and around the project area.
	23	Terrestrial fauna, flora and ecosystem	B-		<Planning Stage / Construction Stage> No rare plant or animal species are reported in the planned area. However, that is to be confirmed by the actual ecosystem survey. There exist a considerable number of trees in the planned area, and the trees are necessary to remove or replanted.
				D	No impact is expected.
	24	Aquatic fauna, flora and ecosystem	C		<Planning Stage / Construction Stage> -No rare aquatic animal species are reported in the planned area. However, that is to be confirmed by the actual ecosystem survey. - A little weakend mangroves exit outside of planned area. However, it is to be confirmed by the actual ecosystem survey whether mangroves exist or not within the planned area.
				D	No impact is expected.
	25	Hydrological situation	B-		<Construction Stage> Excavation and dredging works at the bottom and sides of the river for construction of the bridge may result in changes of hydrological situation of the river.
				C-	Depending on the installation situation of the abutments and piers of the bridge, there is a possibility of partial changes in hydrological situation.

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage Ⅰ / Ⅱ	Stage Ⅲ	
	26	Topography and geology	C-		<Construction Stage> Construction in the project does not involve large-scale land alteration. With regard to terrain of water area, there is a possibility to modify the portion of the riverbed, but that is temporary during construction.
				D	No impact is expected.
	27	Soil erosion	C-		<Construction Stage> Since the scale of land cutting and filling works is small, risk of erosion and destabilization of soil is little even in rainy season.
				D	No impact is expected.
	28	Groundwater	C-		<Construction Stage> There is slight possibility of pumping up the groundwater, if usage of existing water supply is not available. However, the possibility is quite small.
				D	No impact is expected.
Environmental Pollution	29	Air pollution	B-		<Construction Stage> -Operation of transportation vehicles/vessels and heavy machines during the peak time or slow traffic time, temporal deterioration of air quality is expected. -Power for construction work is due to the power generally supplied to the area. However, for blower or pump power generator by diesel fuel is also used, and it is expected that air pollutants such as NOx and particulate matter are exhausted.
				C	-Increase of traffic volume may result in an increase in emission load of air pollutants such as PM, NOx, etc. -On the other hand, traffic congestion and low running on unpaved portion of the road, there is a possibility to reduce air pollution.
	30	Water pollution	B-		<Construction Stage> -Water pollutants from construction site, construction vehicles/vessels, heavy machines and worker's lodgment may be generated. -The water pollution may be caused by soil erosion generated in the ground construction. -Turbid water may be generated from rolling up mud by excavation and dredging work in the riverbed.
				B-	Oil spills and dust on the road surface during rainfall are expected.
	31	Soil contamination	B-		<Construction Stage> There is a possibility of soil contamination caused by emissions of pollutants or oils from the construction site, heavy machines, vehicles and worker's lodgment.
				D	No impact is expected. Because access roads are not slope-typed structure, herbicide may not be used to maintain the surface.
Environmental Pollution	32	Bottom sediment	B-		<Construction Stage> Sedimentation and accumulation of water pollutants generated in the construction work may result in the pollution of bottom sediments.
				D	No impact is expected.
	33	Waste	B-		<Construction Stage> Waste materials, residue soil/sand, dredging sludge, etc., are generated from the construction site. General waste is generated from worker's lodgment.

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage Ⅰ / Ⅱ	Stage Ⅲ	
				D	No impact is expected.
	34	Noise and Vibration	B-		<Construction Stage> From transportation vehicles/vessels and construction heavy machines (including hydraulic hammer) noise and vibration are generated.
				B-	-There is a possibility of increased noise and vibration due to increase in traffic volume. -Since residences along the planned area of access roads are little, the impact is expected to be small.
	35	Land Subsidence	D	D	Since use of groundwater in large quantities is not expected in the project, there is no possibility of land subsidence.
	36	Offensive Odor	C-		<Construction Stage> -There is some possibility of generation of offensive odor if emission control of vehicles, vessels and heavy machines is poor. -There is some possibility of generation of offensive odor released from rolling up mud by excavation and dredging works in the river bottom.
				C-	There is some possibility of generation of offensive odor due to increase in the number of passing vehicles.

<Stage>
Ⅰ : Planning Stage
Ⅱ : Construction Stage
Ⅲ : Operation Stage
<Rating>
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses).
D: No impact is expected.

Source: JICA Study Team

Appendix 1.8 Terms of Reference (TOR) of Surveys on Environmental and Social Considerations

For items selected from the results of scoping, details and methods were set as the terms of reference (TOR).

Table A1.30 shows the TOR of surveys on environmental and social considerations.

Table A1.30 TOR of Surveys on Environmental and Social Considerations

Environmental Item		Survey Item	Details and Methods of the Survey
Social Environment			
(1)	Land acquisition and involuntary resettlement	1) -Conditions of residents, buildings, and occupation of land in areas affected by the project. -If there is any occupation, details and number of project affected units (PAUs)/project affected persons (PAPs) based on the census survey	1) -Confirmation of the conditions of habitation around the concerned area and conditions of occupation of buildings and land, based on the satellite photos of the concerned areas, field surveys, and local materials. -Census and socioeconomic surveys of PAUs/PAPs (outsource to a local
		2) -Laws, regulations, policies, and examples in Myanmar concerning EIA and acquisition of land and resettlement. -Comparison with the JICA guidelines.	2) Collection of information/materials, and hearing with PW and concerned government offices of Myanmar.
		3) Request and support to PW for preparation of abbreviated resettlement plan (ARP), creation of framework and implementation.	3)-Request to PW for formulation of ARP and creation of implementation system. -Explanation about the details of ARP and discussion with the leader on the
(2)	Poor people	Conditions of poor people in and around the project site.	- Collection of existing township information related to poor people. -Site observation.
(3)	Local economy such as employment and livelihood, etc.	Conditon of labor force in the township including the project site.	Collection of the existing township data of labor force.
(4)	Utilization of land and local resources	Conditions of land use, and presence of resources around the project site.	Collection of the existing materials.
(5)	Water usage	Conditions of water use in and around the project site.	-Collection of township information concerning water use, and hearing (YCDC). -Site observation.
(6)	Existing social infrastructure and services	1)Situation of traffic volume, traffic restriction, etc., around the project site. 2)Situation of structures, lines, and social service facilities related to infrastructures.	1)-Collection of the existing materials. -Hearing and data taking from local governments/organizations. -Observation survey in the project site. 2)Hearing with local government such as YCDC.
(7)	Misdistribution of benefits and damages	Expected damages and benefits.	-Consideration on the details of the benefits to the areas assumed in the project plan, and the negative impacts to areas where residents lived were assumed in the environmental impact assessment. -Hearing with the concerned authorities.
(8)	Cultural, historical, archaeological and religious heritage site	Cultural values and current conditions of various religious facilities existing in and around the project site.	Survey of materials Hearing with related persons

(9)	Water rights, fishing rights, and rights of common	1)Conditions in the setting of water rights, fishing rights on the rivers in the project sites, and rights of the common in the forests in the peripheral areas.	Collection of information and hearing from related authorities.
(10)	Landscape	Landscape evaluation with the surrounding landscape elements and bridge design.	Consideration of bridge design and harmonization between the new bridge and surrounding/existing bridge.
(11)	Rights of children	1)Current conditions of park usage by children in the south side of the bridge. 2)Consideration of mitigation measures in the reduction of the playground	1)Hearing with related local government (YCDC) 2)Consultation with related local government (YCDC, township)
(12)	Public health and sanitation	Conditions of medical care, health and sanitation facilities around the project sites.	Collection of existing materials (Department of Health Services) and hearing (YCDC, township).
(13)	Infectious diseases such as HIV/AIDS	Conditions of tested and positive persons with infectious diseases such as HIV/AIDS around the project site.	Collection of existing materials (Department of Health Services).
(14)	Working conditions (including occupational health)	1) Laws and regulations in Myanmar concerning working and conditions/work safety. 2)Case example of other project.	1)Survey of laws and regulations. 2)Survey of existing cases.
(15)	Accidents	Current state of traffic accidents in areas around the project site.	Collection of accident occurrence data by township area.
Natural Environment			
(16)	Terrestrial fauna, flora and ecosystems	Current state of biota and ecosystems.	-Actual field survey (outsource to a local consultant), -Survey with existing materials
(17)	Aquatic fauna, flora and ecosystems	Current state of biota and ecosystems.	-Actual environmental survey (outsource to a local consultant), -Collection of existing materials
(18)	Hydrological situation	1)Current hydrological situation 2)Contents of the construction work plan on the river site	1)Actual environmental survey (River flow rate, river cross section) (outsourcing to a local consultant) 2)Grasp of construction plan for pier-abutment installation, excavation, dredging, etc.
(19)	Soil erosion	Conditions of topography, geology and soil of the project site.	Collection of existing materials.
(20)	Groundwater	Presence or absence of groundwater use in construction.	Confirmation of the water used in the construction plan.
Environmental Pollution			
(21)	Air pollution	1)Current state of traffic volume. 2)Current state of air quality.	1) Traffic volume as a condition of the bridge design. 2)Actual field survey (outsource to a local consultant), hearing survey.
(22)	Water pollution	Current state of water quality of the river.	Actual environmental survey (outsource to a local consultant)
(23)	Soil contamination	Possibility of discharging pollutants to the soil during construction	Verification of the discharge potential and control of soil contamination during construction work
(24)	Bottom sediment	Current state of bottom sediment of the rivers.	Actual environmental survey (outsource to a local consultant)

(25)	Waste	1)Current situation of treatment and disposal of waste in the region. 2)Methods of treatment and disposal of construction waste and general waste during construction.	1)Collection of information related to treatment and disposal of waste in the region where the project sites are located. 2)Confirmation of methods of treatment/ disposal of construction waste and general waste in the construction plan.
(26)	Noise and vibration	1)Current state of traffic volume. 2)Current state of ambient noise level.	1)Traffic volume as a condition of the bridge design 2)Actual environmental survey (outsource to a local consultant), Hearing
(27)	Offensive odor	Consideration of the possible impact of offensive odor (on land and water).	Survey of existing case example (on land and water).

Source : JICA Study Team

Appendix 1.9 Results of the Survey on Environmental and Social Considerations

The main items of the results of the survey on environmental and social considerations are shown below.

(1) Social Environment

A) Planning Stage

<Structure Relocation and Resettlement>

-Involuntary resettlement:

Three employees of the two automobile repair workshops in northside of the bridge.

One employee of 24 hours snack shop and three persons of Game shop (shop owner and his family) in southside of the bridge.

-Structures replacement:

Three automobile repair workshops near the interchange in north side of the bridge.

Four shops (in two structures) around the park in south side of the bridge.

<Right of Children>

- Reduction of the children's playground in the park located southside of the bridge.

B) Construction Stage

- Existing social infrastructures and services (temporal and partial closure of roads, one-way reduction, relocation/replacement of electric poles, and impact on river traffic of ships).

List of existing electric poles within the planned area is shown in Table A1.31. There are 26 electric poles including small poles for light bulb and poles for telephone network. Trees are required to be replaced.

On each pole in the list, an identifying number tape is fixed, which corresponds to the number shown in Table A1.31.

Table A1.31 List of Existing Electric Poles within the Planned Area

No.	Coordinates X			Coordinates Y			Electric Pole	Township
	De.	Mi.	Se.	De.	Mi.	Se.		
1	16	47	15.6	96	10	39.1	Pole for cabling	Mingalar Taung Nyut
2	16	47	15.6	96	10	39.2	Pole for cabling	Mingalar Taung Nyut
3	16	47	15.6	96	10	39.2	Pole for cabling	Mingalar Taung Nyut
4	16	47	15.5	96	10	39.0	Pole with bulb	Mingalar Taung Nyut
5	16	47	14.5	96	10	39.2	Pole with bulb	Mingalar Taung Nyut
6	16	47	14.6	96	10	37.9	Pole with bulb	Mingalar Taung Nyut
7	16	47	11.6	96	10	39.7	Pole with bulb	Mingalar Taung Nyut
8	16	47	11.5	96	10	39.5	Small pole without bulb in triangle garden	Mingalar Taung Nyut
9	16	47	11.9	96	10	39.4	Small pole without bulb in triangle garden	Mingalar Taung Nyut
10	16	47	11.8	96	10	39.1	Small pole without bulb in triangle garden	Mingalar Taung Nyut
11	16	47	12.0	96	10	38.9	Small pole without bulb in triangle garden	Mingalar Taung Nyut
12	16	47	11.9	96	10	38.7	Pole with bulb	Mingalar Taung Nyut
13	16	47	11.2	96	10	38.8	Pole with bulb	Mingalar Taung Nyut
14	16	47	11.2	96	10	38.8	Small pole without bulb in triangle garden	Mingalar Taung Nyut
15	16	47	10.8	96	10	38.5	Small pole without bulb in triangle garden	Mingalar Taung Nyut
16	16	47	10.8	96	10	38.3	Small pole without bulb in triangle garden	Mingalar Taung Nyut
17	16	47	10.3	96	10	37.6	Pole with bulb	Mingalar Taung Nyut
18	16	47	10.1	96	10	41.6	Pole for cabling in MOC compound	Mingalar Taung Nyut
19	16	47	10.0	96	10	41.7	Pole for cabling in MOC compound	Mingalar Taung Nyut
20	16	47	3.2	96	10	49.8	Pole for cabling	Dawbon
21	16	47	3.1	96	10	49.6	Telecommunications pole	Dawbon
22	16	47	2.3	96	10	50.1	Pole for cabling	Dawbon
23	16	47	2.3	96	10	50.3	Telecommunications pole	Dawbon
24	16	47	0.7	96	10	50.9	Pole with bulb	Dawbon
25	16	47	0.1	96	10	51.5	Pole with bulb	Dawbon
26	16	46	59.5	96	10	52.2	Pole with bulb	Dawbon

Source: JICA Study Team

- Misdistribution of benefits and damages (in case that explanation of the plan to inhabitants and concerned regional organizations is insufficient.)

-Public health and sanitation (Concern of respiratory diseases occurrence due to air pollutants exhausted from vehicles and heavy machines)

-Infectious diseases such as HIV/AIDS (by contact of migrating workers/drivers with local women)

- Working condition (Risks of impairment to the health and safety of construction workers).

-Accident (Accidents caused by transportation vehicles/vessels, heavy machines, etc.)

(2)Natural Environment

A) Planning Stage

<Trees to be removed or transplanted and/or alternative planting >

- A lot of trees (not rare species) exist in the project affected area.

-It is necessary to submit the application document including data of tree species, location, and numbers of trees, to the department and is necessary to obtain its permission.

-After planning, the area of new bridges and access roads was determined, survey of all trees in the affected area was conducted. Results of the survey are shown in Table A1.32 and Table A1.33.

There are 71 trees in Mingalar Taung Nyunt Township, and 69 trees in Dawbon Township.

Two vulnerable species in the IUCN Red List, namely, *Delonix regia* (Flame tree) and *Swietenia macrophylla* King (mahogany), do not exist in the planned access road area.

On each tree in the list, a plate was fitted corresponding to the number shown in Table A1.32.

Table A1.32 Trees Existing in the Affected Area in (1) Mingalar Taung Nyunt Township

No.	Existing Position						Tree Species	Height (m)	Diameter at Breast Height	Shape of the Tree	Living Condition
	Coordinates X			Coordinates Y							
	De.	Mi.	Se.	De.	Mi.	Se.					
1	16	47	14.2	96	10	39.3	*Samanea saman* (Jacq.) Merr.	5	0.6	V-shaped	Living
2	16	47	13.9	96	10	39.4	*Samanea saman* (Jacq.) Merr.	5.2	0.8	V-shaped	Living
3	16	47	13.6	96	10	39.4	*Samanea saman* (Jacq.) Merr.	5.4	0.9	V-shaped	Living
4	16	47	13.5	96	10	39.4	*Samanea saman* (Jacq.) Merr.	5	0.6	V-shaped	Living
5	16	47	13.3	96	10	39.5	*Samanea saman* (Jacq.) Merr.	5.3	0.5	V-shaped	Living
6	16	47	13.0	96	10	39.5	*Terminalia catappa L.*	4.6	0.4	V-shaped	Living
7	16	47	12.8	96	10	39.5	*Ceiba pentendra*	6	0.9	V-shaped	Living
8	16	47	12.8	96	10	39.6	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	6.3	0.9	V-shaped	Living
9	16	47	12.7	96	10	39.5	*Samanea saman* (Jacq.) Merr.	4	0.3	V-shaped	Living
10	16	47	12.6	96	10	39.6	*Samanea saman* (Jacq.) Merr.	6.5	0.5	V-shaped	Living
11	16	47	12.5	96	10	39.6	*Samanea saman* (Jacq.) Merr.	6.7	0.5	V-shaped	Good/health
12	16	47	12.4	96	10	39.5	*Samanea saman* (Jacq.) Merr.	6	0.6	V-shaped	Good/health
13	16	47	12.4	96	10	39.6	*Samanea saman* (Jacq.) Merr.	6.7	0.8	V-shaped	Good/health
14	16	47	12.3	96	10	39.6	*Samanea saman* (Jacq.) Merr.	6.7	0.9	V-shaped	Good/health
15	16	47	12.4	96	10	39.7	*Samanea saman* (Jacq.) Merr.	6.7	0.8	V-shaped	Good/health
16	16	47	12.3	96	10	39.8	*Samanea saman* (Jacq.) Merr.	6.5	0.5	V-shaped	Living
17	16	47	12.3	96	10	39.9	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	6.5	1	V-shaped	Living
18	16	47	11.9	96	10	39.9	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	6.5	1.1	V-shaped	Good/health
19	16	47	11.8	96	10	39.7	*Ceiba pentendra*	6.6	0.9	V-shaped	Living
20	16	47	11.7	96	10	39.7	*Ceiba pentendra*	6.6	0.9	V-shaped	Living
21	16	47	11.6	96	10	39.7	*Casuarina equisetifolia*	7	1.2	V-shaped	Living
22	16	47	11.6	96	10	39.9	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	6	0.6	V-shaped	Living
23	16	47	11.5	96	10	39.8	*Ceiba pentendra*	4	0.5	V-shaped	Living
24	16	47	11.3	96	10	40.0	*Samanea saman* (Jacq.) Merr.	11	1.3	V-shaped	Good/health
25	16	47	11.3	96	10	40.3	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	4.5	0.7	V-shaped	Living
26	16	47	11.1	96	10	40.4	*Ceiba pentendra*	6.8	0.6	V-shaped	Living
27	16	47	10.7	96	10	40.7	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	9	1	V-shaped	Good/health

No.	Existing Position						Tree Species	Height (m)	Diameter at Breast Height	Shape of the Tree	Living Condition
	Coordinates X			Coordinates Y							
	De.	Mi.	Se.	De.	Mi.	Se.					
28	16	47	10.3	96	10	41.1	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	8.5	1.1	V-shaped	Good/health
29	16	47	11.8	96	10	40.4	*Mangifera indica* (Mango)	4.5	0.5	V-shaped	Living
30	16	47	11.5	96	10	40.4	*Mangifera indica* (Mango)	4.5	0.6	V-shaped	Living
31	16	47	11.6	96	10	40.1	*Mangifera indica* (Mango)	6	0.6	V-shaped	Living
32	16	47	11.6	96	10	40.1	*Mangifera indica* (Mango)	6.4	0.7	V-shaped	Living
33	16	47	11.5	96	10	40.2	*Mangifera indica* (Mango)	6.5	0.7	V-shaped	Living
34	16	47	11.4	96	10	40.2	*Mangifera indica* (Mango)	6.5	0.7	V-shaped	Living
35	16	47	11.1	96	10	40.8	*Tamarindus Indicus*	6	0.5	V-shaped	Living
36	16	47	11.1	96	10	40.9	*Cocos nucifera*	7	1	V-shaped	Living
37	16	47	10.9	96	10	41.1	*Gomphostemma strobilinum*	7	9	V-shaped	Good/health
38	16	47	11.2	96	10	41.5	*Artocarpus heterophyllus*	5.7	0.8	V-shaped	Living
39	16	47	10.5	96	10	42.0	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	4.8	0.8	V-shaped	Good/health
40	16	47	10.3	96	10	41.6	Cocos nucifera	5	1	Columnar	Living
41	16	47	10.3	96	10	41.8	*Mangifera indica* (Mango)	10	1.4	V-shaped	Good/health
42	16	47	10.3	96	10	42.0	*Mangifera indica* (Mango)	10	1	V-shaped	Good/health
43	16	47	10.2	96	10	42.1	*Cocos nucifera*	10	0.9	V-shaped	Living
44	16	47	10.1	96	10	42.2	*Eugenia bracteolata*	10	0.7	V-shaped	Good/health
45	16	47	10.2	96	10	42.3	*Eugenia bracteolata*	8	0.5	V-shaped	Living
46	16	47	9.6	96	10	41.9	*Cocos nucifera*	10	3	V-shaped	Good/health
47	16	47	9.4	96	10	42.6	*Terminalia catappa L.*	8	0.8	V-shaped	Good/health
48	16	47	12.1	96	10	40.7	*Pterocarpus macrocarpus*	7.5	0.9	V-shaped	Good/health
49	16	47	12.0	96	10	40.5	Mangifera indica (Mango)	10	0.8	V-shaped	Good/health
50	16	47	12.1	96	10	40.5	*Cocos nucifera*	10	0.8	Columnar	Living
51	16	47	12.3	96	10	40.2	*Mangifera indica* (Mango)	4.5	0.7	V-shaped	Living
52	16	47	12.4	96	10	39.1	*Syagrus romanzoffiana*	4.5	1.3	Columnar	Living
53	16	47	12.3	96	10	38.9	*Syagrus romanzoffiana*	4.5	1.3	Columnar	Living
54	16	47	12.1	96	10	38.7	*Syagrus romanzoffiana*	4.5	1.3	Columnar	Living
55	16	47	12.0	96	10	38.6	*Syagrus romanzoffiana*	4.5	1.3	Columnar	Living
56	16	47	11.9	96	10	38.9	*Syagrus romanzoffiana*	4.5	1.4	Columnar	Living
57	16	47	11.8	96	10	39.0	*Syagrus romanzoffiana*	4.3	1.2	Columnar	Living
58	16	47	11.6	96	10	39.1	*Syagrus romanzoffiana*	5	1.9	Columnar	Living
59	16	47	11.5	96	10	39.3	*Syagrus romanzoffiana*	5	1.9	Columnar	Living
60	16	47	11.8	96	10	39.3	*Syagrus romanzoffiana*	5	1.7	Columnar	Living
61	16	47	10.9	96	10	39.0	*Syagrus romanzoffiana*	5	0.8	Columnar	Living
62	16	47	11.1	96	10	38.8	*Syagrus romanzoffiana*	5	0.9	Columnar	Living
63	16	47	11.2	96	10	38.6	*Syagrus romanzoffiana*	5	0.9	Columnar	Living
64	16	47	11.2	96	10	38.5	*Syagrus romanzoffiana*	5	0.9	Columnar	Living
65	16	47	11.0	96	10	38.4	*Syagrus romanzoffiana*	5	0.8	Columnar	Living
66	16	47	10.8	96	10	38.4	*Syagrus romanzoffiana*	5	1	Columnar	Living
67	16	47	10.7	96	10	38.3	*Syagrus romanzoffiana*	5	0.9	Columnar	Living
68	16	47	10.7	96	10	38.5	*Syagrus romanzoffiana*	5	0.8	Columnar	Living
69	16	47	10.8	96	10	38.7	*Syagrus romanzoffiana*	5	1	Columnar	Living
70	16	47	10.8	96	10	38.9	*Syagrus romanzoffiana*	2	0.7	Columnar	Living
71	16	47	10.0	96	10	37.8	*Ficus rumphii* Blume	9	3	V-shaped	Living

Source : JICA Study Team

Table A1.33 Trees Existing in the Affected Area in (2) Dawbon Township

No.	Existing Position						Tree Species	Height (m)	Diameter at Breast Height	Shape of the Tree	Living Condition
	Coordinates X			Coordinates Y							
	De.	Mi.	Se.	De.	Mi.	Se.					
72	16	47	12.8	96	10	40.3	*Ficus rumphii* Blume	4.3	1.5	V-shaped	Living
73	16	47	5.0	96	10	47.6	*Mimusops elengi* L.	4.1	0.5	V-shaped	Living
74	16	47	3.7	96	10	48.1	*Pterocarpus macrocarpus*	6	0.6	V-shaped	Living
75	16	47	3.8	96	10	48.1	*Pterocarpus macrocarpus*	6	0.6	V-shaped	Living
76	16	47	4.0	96	10	48.4	*Samanea saman* (Jacq.) Merr.	6	0.8	V-shaped	Living
77	16	47	4.0	96	10	48.4	*Samanea saman* (Jacq.) Merr.	6	0.7	V-shaped	Living
78	16	47	4.0	96	10	48.5	*Pterocarpus macrocarpus*	7	0.8	V-shaped	Living
79	16	47	2.1	96	10	50.2	*Samanea saman* (Jacq.) Merr.	7	2.8	V-shaped	Living
80	16	47	1.9	96	10	50.4	*Samanea saman* (Jacq.) Merr.	7	0.8	V-shaped	Living
81	16	47	1.7	96	10	50.6	*Samanea saman* (Jacq.) Merr.	10.5	2	V-shaped	Living
82	16	47	1.6	96	10	50.7	*Samanea saman* (Jacq.) Merr.	10	0.8	V-shaped	Living
83	16	47	1.4	96	10	50.8	*Terminalia catappa* L.	9.5	0.6	V-shaped	Living
84	16	47	1.5	96	10	50.8	*Borassus flabelliafera* (Palmyra Plan)	3	1.2	Columnar	Living
85	16	47	1.1	96	10	50.9	*Samanea saman* (Jacq.) Merr.	9.5	0.7	V-shaped	Living
86	16	47	1.0	96	10	51.0	*Ficus glomerata* (Country	9.5	0.6	V-shaped	Living
87	16	47	1.0	96	10	50.7	*Pterocarpus macrocarpus*	10	1.2	V-shaped	Living
88	16	47	1.2	96	10	49.9	*Piper attenuatum*	5	0.7	V-shaped	Living
89	16	47	1.1	96	10	50.3	*Piper attenuatum*	5	0.7	V-shaped	Good/health
90	16	47	1.1	96	10	50.4	*Piper attenuatum*	5.5	0.8	V-shaped	Good/health
91	16	47	1.1	96	10	50.4	*Piper attenuatum*	5.6	0.8	V-shaped	Living
92	16	47	1.0	96	10	50.6	*Piper attenuatum*	5.3	0.6	V-shaped	Living
93	16	47	0.8	96	10	50.7	*Casuarina equisetifolia*	8.5	1	V-shaped	Living
94	16	47	0.9	96	10	50.7	*Piper attenuatum*	4.5	0.5	V-shaped	Living
95	16	47	0.9	96	10	51.2	*Pterocarpus macrocarpus*	10.5	1	V-shaped	Living
96	16	47	0.9	96	10	51.2	*Ceiba pentendra*	10.8	0.9	V-shaped	Living
97	16	47	0.6	96	10	50.9	*Piper attenuatum*	4.5	0.7	V-shaped	Living
98	16	47	0.5	96	10	51.0	*Piper attenuatum*	5.6	0.7	V-shaped	Living
99	16	47	0.5	96	10	51.0	*Piper attenuatum*	4.5	0.6	V-shaped	Living
100	16	47	0.5	96	10	51.1	*Samanea saman* (Jacq.) Merr.	10	0.9	V-shaped	Good/health
101	16	47	0.5	96	10	51.2	*Samanea saman* (Jacq.) Merr.	10.6	0.7	V-shaped	Good/health
102	16	47	0.3	96	10	51.2	*Piper attenuatum*	5.3	0.7	V-shaped	Living
103	16	47	0.4	96	10	51.2	*Piper attenuatum*	5.3	0.8	V-shaped	Living
104	16	47	0.4	96	10	51.2	*Samanea saman* (Jacq.) Merr.	10.5	1	V-shaped	Good/health
105	16	47	0.3	96	10	51.4	*Piper attenuatum*	3.5	0.5	V-shaped	Living
106	16	47	0.2	96	10	51.4	*Samanea saman* (Jacq.) Merr.	10	0.7	V-shaped	Good/health
107	16	47	0.1	96	10	51.4	*Piper attenuatum*	5.5	0.6	V-shaped	Living
108	16	47	0.0	96	10	51.4	*Casuarina equisetifolia*	10.5	1	V-shaped	Living
109	16	47	0.0	96	10	51.6	*Piper attenuatum*	5	0.6	V-shaped	Living
110	16	47	0.0	96	10	51.8	*Piper attenuatum*	5.7	0.9	V-shaped	Living
111	16	46	59.8	96	10	51.9	*Piper attenuatum*	2	0.5	V-shaped	Living
112	16	46	59.7	96	10	52.0	*Piper attenuatum*	5.3	1	V-shaped	Living
113	16	46	59.8	96	10	52.0	*Borassus flabelliafera* (Palmyra Plan)	4	1.3	Columnar	Living
114	16	46	59.7	96	10	52.0	*Piper attenuatum*	3.5	0.6	V-shaped	Living

No.	Existing Position						Tree Species	Height (m)	Diameter at Breast Height	Shape of the Tree	Living Condition
	Coordinates X			Coordinates Y							
	De.	Mi.	Se.	De.	Mi.	Se.					
115	16	46	59.7	96	10	52.1	*Piper attenuatum*	9	0.9	V-shaped	Living
116	16	46	59.6	96	10	52.1	*Piper attenuatum*	3	0.3	V-shaped	Living
117	16	46	59.6	96	10	52.2	*Casuarina equisetifolia*	10	0.9	V-shaped	Living
118	16	46	59.6	96	10	52.1	*Samanea saman* (Jacq.) Merr.	10	0.8	V-shaped	Good/health
119	16	46	59.6	96	10	52.2	*Piper attenuatum*	4.5	0.5	V-shaped	Living
120	16	46	59.4	96	10	52.2	*Casuarina equisetifolia*	10.5	0.9	V-shaped	Living
121	16	46	59.3	96	10	52.2	*Piper attenuatum*	4.7	0.8	V-shaped	Living
122	16	46	59.3	96	10	52.3	*Piper attenuatum*	4.7	0.8	V-shaped	Living
123	16	46	59.5	96	10	52.4	*Piper attenuatum*	4.7	0.6	V-shaped	Living
124	16	46	59.2	96	10	52.7	*Casuarina equisetifolia*	10	0.9	V-shaped	Living
125	16	46	59.3	96	10	52.6	*Piper attenuatum*	5	0.8	V-shaped	Living
126	16	46	59.2	96	10	52.8	*Piper attenuatum*	5	0.5	V-shaped	Living
127	16	46	59.3	96	10	51.8	*Piper attenuatum*	5.7	0.6	V-shaped	Living
128	16	46	59.3	96	10	51.9	*Piper attenuatum*	5.7	0.6	V-shaped	Living
129	16	46	59.0	96	10	51.9	*Piper attenuatum*	5.3	0.7	V-shaped	Living
130	16	46	59.1	96	10	52.1	*Piper attenuatum*	4.3	0.3	V-shaped	Living
131	16	46	59.1	96	10	52.1	*Piper attenuatum*	4.3	0.3	V-shaped	Living
132	16	46	58.9	96	10	52.0	*Terminalia catappa L.*	4	0.5	V-shaped	Living
133	16	46	59.0	96	10	52.3	*Piper attenuatum*	3	0.3	V-shaped	Living
134	16	46	58.8	96	10	52.4	*Piper attenuatum*	3.7	0.4	V-shaped	Living
135	16	46	58.8	96	10	52.4	Samanea saman (Jacq.) Merr.	5	1	Columnar	Living
136	16	46	58.7	96	10	52.5	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	4.5	0.5	Columnar	Living
137	16	46	58.6	96	10	52.7	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	5	0.6	Columnar	Living
138	16	46	58.6	96	10	52.7	*Polyathia longifolia* (Lam.) Benth.& Hook.f.	4.5	0.5	V-shaped	Living
139	16	46	58.5	96	10	52.7	*Tamarindus Indicus* (Tamarind Tree)	5	0.4	V-shaped	Living
140	16	46	58.5	96	10	52.9	*Samanea saman* (Jacq.) Merr.	6.3	0.6	V-shaped	Good/health

Source : JICA Study Team

B) Construction Stage

< Hydrological situation>

-Changes to the hydrological situation as caused by excavation and dredging works for construction of abutments and piers.

(3) Environmental Pollution

A) Construction Stage

-Air pollution (during peak time of operation of the transportation vehicles/vessels and heavy machines and during operation of diesel fuel generator).

-Water pollution (turbid water from construction site, drainage and oil discharged from transportation vehicles/vessels, heavy machines or worker's lodge).

-Soil contamination (turbid water from drainage and oil discharged from construction site, transportation vehicles/vessels, heavy machines or construction lodge).

-Bottom sediment (sand/sediment, pollutants and soar of bottom mud generated by construction works of dredging/excavation or construction of piers).

-Waste (dredging sludge, waste sand/soil and other construction materials waste from construction site, daily general waste from worker's lodge, etc.)

-Noise and vibration (by transportation vehicles/vessels, heavy machines including during construction work of abutment/piers, etc.)

B) Operation Stage

-Air pollution (increase of air pollution due to increase in traffic volume. On the other hand, reduction of air pollution due to resolution of traffic congestion).

-Noise and vibration（increase of air pollution noise and vibration due to increase in traffic volume). However, facilities that need quiet environment are less near the access roads.

On the other hand, there will be reduction of noise and vibration due to resolution of traffic congestion.

Appendix 1.10 Mitigation Measures and Their Costs

Table A1.34 shows the mitigation measures as well as their costs such as items classified as "B-" in the EIA.

Table A1.34 Mitigation Measures and Their Costs

Environmental Item	Mitigation Measures	Implementing Organization	Responsible Organization	Cost Burdened by the Organization
Planning Stage				
Social Environment				
1 Land acquisition and involuntary resettlement	1)As regards to the structures relocation and resettlement, PW will explain the plan and policy through a public information campaign to stakeholders and obtain agreements. 2)Structures that might be affected shall be listed up. Information of PAPs shall be obtained. 3)Based on identification of the eligibility of PAPs, compensation and support shall be conducted for each PAP. 4)PW shall create an abbreviated resettlement plan (ARP) and PW shall implement structures for relocation and resettlement based on the ARP.	PW	PW	PW Cost is booked in ARP
2 Water rights, fishing rights and rights of common	For using and occupying the land under the ownership and control of MPA, it is necessary to apply to MPA and obtain its permission.	PW MPA	PW	PW
Natural Environment				
3 Terrestrial fauna, flora and ecosystem	1)According to the instruction from the Forest Department of MOECAF, removal or transplanting and/or alternative planting of trees, at first, it has to submit an application document including data of	PW YCDC -PPGD Contractor	PW	PW 4) MMK 14,000

Environmental Item	Mitigation Measures	Implementing Organization	Responsible Organization	Cost Burdened by the Organization
	tree species, location and numbers of trees to the department in order to obtain a permission. 2)Effort shall be done so that cutting the trees will be avoided as possible. 3)For removal or transplanting and/or alternative planting, PW shall apply in advance to YCDC-Playgrounds, Parks and Gardening Department (PPGD) and follow the instruction. 4)For actual action is supported by YCDC-PPGD and PW shall pay as prescribed.			thousand (for 140 trees) (Pay to PPGD)
Construction Stage				
Social Environment				
5 Existing social infrastructures and services	1)In the construction plan, consideration should be given so as not to interfere with the access to social service facilities. 2)Prior to public announcement of construction work schedule and temporary traffic restrictions. 3)Time shift of transportation work, if necessary. 4)Placement of traffic control personnel. 5)Assign staff in charge of complaints from inhabitants. 6)Transportation by vessels and heavy equipment operation in the river are planned so as not to affect the waterway as much as possible. 7)Construction, the location of the pier abutment of the new bridge, is designed so that there is no need to change the current route. 8)With regard to replacement of electric poles, PW shall apply the plan to the Myanmar Electronic Power Enterprise (MEPE) and obtain approval in advance. Then ask the requirement of actual work by concerning organization.	PW Contractor	PW MEPE	Contractor 8) :PW MMK 3,900 thousand (Replacement of electric poles)
6 Misdistribution of benefits and damages	1)PW shall explain the environmental impact caused by the operation of transportation vehicles/heavy machines and generation of waste, and consider to build a consensus of no possibility of misdistribution of benefits and damages during construction. 2)Consideration on employment priority should be given to local residents for simple construction work.	PW	PW	PW
7 Rights of the children	To require YCDC or the Dawbon Township government, to plan the installation of a new playground or park in place of the playground that will be affected.	PW	PW	PW
8 Public health and sanitation	1) -5) Similar mitigation measures to air pollution (Item 11)	Contractor PW	PW	Contractor
9 Infectious diseases such as HIV/AIDS	1)Thorough education in the prevention and cure of HIV/AIDS to migrating construction workers. 2)Education in the prevention of HIV/AIDS to inhabitants. 3) Preferential employment of local residents as much as possible.	Contractor /PW	PW	Contractor 1), 2) MMK 100 thousand (Education material)
10 Working condition	1)The contractor and employed workers shall comply with the laws and regulations of Myanmar relating to the working conditions and environment.	Contractor PW	PW	Contractor

Environmental Item	Mitigation Measures	Implementing Organization	Responsible Organization	Cost Burdened by the Organization
(including occupational health)	2) The contractor should take tangible safety measures as follows: -Installation of safety equipment which prevents work accidents - Physical zoning of safety work area. 3) The contractor should take intangible safety measures as follows: -To prepare the safety and health management plan, including traffic safety, accident prevention and public sanitation, etc. according to the regulations related to working conditions. -To conduct educational training on safety, health and public sanitation to workers and staffs. 4)The contractor should implement proper and strict management and education of security guards not to infringe safety and security of residents and staffs/ workers. The construction supervisor should regularly check the behavior of the security guards, and guide strictly, if there is an inappropriate behavior.			
11 Accidents	1)Select the transportation route on land and on water that has lowest possibility of accident. 2)Post signs on the main roads and waterways to inform the time zone and passage of transportation vehicles/vessels. 3)Clarification of the boundaries of the construction areas with rope, fences, among other means. 4)Thorough instruction on safety driving and working to drivers/pilot of transportation vehicles/vessels. 5)Prior to public announcement on the contents and schedule of loading and unloading materials and equipment, construction work schedule, and temporary traffic restrictions. 6)Time shift of construction work and operation of transport vehicles and vessels, if necessary.	PW Contractor	PW	Contractor
Natural Environment				
12 Hydrological situation	Monitor the change in water bed and flow regime during construction of abutments and piers of the bridge and take measures for construction action which minimize the changes, if necessary.	PW Contractor	PW	PW
Environmental Pollution				
13 Air pollution	1)Proper control of exhaust gas from transportation vehicles and heavy machines (sufficient inspection and maintenance of the treatment equipment of exhaust gas) and using good quality fuel and oil. 2)Sprinkle water to prevent scattering of dust from the construction site where soil soars during excavation and transportation. 3) Regulation of overloaded transportation vehicles. 4) Assign staff in charge of complaints from inhabitants and construction activity improvement corresponding to the complaints. 5) Construction work should not be carried out principally at night (construction period : 7:00 a.m.-7:00 p.m.).	Contractor PW	Contractor PW	Contractor 7) :PW

Environmental Item	Mitigation Measures	Implementing Organization	Responsible Organization	Cost Burdened by the Organization
	6) Restrictions on the place and time of use of diesel generators. 7) Air quality monitoring around the access roads.			
14 Water pollution	1)If necessary, sedimentation basin or silt trap shall be installed for construction waste water of high turbidity and after precipitation of sand and sediment, and the supernatant water will be discharged into the river. 2)Oils, etc., of transportation vehicles and construction heavy machines shall be used with no leakage, and waste oils shall be stored and disposed safely. 3)Concrete curing water shall be discharged after neutralization. 4)Ready-mix concrete is purchased directly from the plant in the city. In the construction site, only concrete placement is done and waste shall be returned to the plant.	Contractor PW	Contractor PW	Contractor 1) MMK 9,000 thousand
15 Soil contamination	Contaminants such as oils discharged from construction heavy machines or vehicles shall be storage adequately and disposed safely.	Contractor	Contractor PW	Contractor
16 Bottom sediment	1)To use the adequate method to prevent the rolling up or scattering of bottom mud during the dredging or excavation of the river bottom. 2)When rolling up/scattering of bottom mud and turbid water are generated intensively, construction work shall be done by the method such as waiting sometime for settling of suspended mud.	Contractor	Contractor PW	Contractor MMK 6,000 thousand
17 Waste	1)The contractor should carry out proper segregation, collection, treatment, and disposal of construction waste in strict compliance with waste-related laws of Myanmar and regulations and rules of YCDC. 2)Waste which cannot be treated or disposed in the local area should be brought back by the contractor and treated and disposed appropriately according to the regulation of the local government of the area where the waste are brought in. 3)Remained sand/soil should be stocked in the spoil bank with measures of spill prevention from rainwater. Then stocked sand and soil should be backfilled in principle. Backfilled surface should be adequately compacted. 4)To stock and safely dispose oils, etc., used by heavy machines and vehicles. 5) The contractor shall provide education and enlightenment for the above activities (decreasing quantity, segregation, reuse and recycling) to workers. 6)Worker's camp will not be built in the construction site. Existing dormitory or hotel will be rent out. 7)To install temporary toilets of septic tank type in the construction site.	Contractor	Contractor PW	Contractor 7) MMK 3,000 thousand （Temporary toilets）
18 Noise and vibration	1)To maintain thoroughly the vehicles, vessels, and heavy machines, and operate at low noise and vibration conditions.	Contractor	Contractro PW	Contractor

Environmental Item	Mitigation Measures	Implementing Organization	Responsible Organization	Cost Burdened by the Organization
	2)To install soundproof fence or a buffer zone, if necessary. 3)Construction work should not be carried out principally at night (construction period: 7:00 a.m.-7:00 p.m). 4)To assign staff in charge of the complaints from inhabitants and construction activity improvement corresponding to the complaints. 5)To use low noise/vibration hydraulic hammer.			
Operation Stage				
Social Environment				
19 Public health and sanitation	1)Control and induction of traffic so as not to cause traffic congestion. 2)Regulation of overloaded trucks, etc. 3)Early detection of symptoms and response in collaboration with medical staff and health facilities.	Contractor PW	PW Contractor	PW
20 Accidents	1)Adequate training for the enlightenment and education of drivers and foot passenger about traffic safety. 2)Regulation of overloaded truck and vehicle speed.	Contractor PW	Contractor PW	PW
Natural Environment				
Environmental Pollution				
22 Air pollution	1)Control and induction of traffic so as not to cause traffic congestion. 2)Regulation of overloaded trucks, etc. 3)Air quality monitoring around the road.	PW	PW	PW
23 Noise and vibration	1)Control and induction of traffic so as not to cause traffic congestion. 2)Regulation of overloaded trucks, etc. 3)Noise monitoring around the road.	PW	PW	PW
	Total Cost	Cost without the indication of the amount PW: Within the project management cost: Contractor: within the construction management cost:		MMK 36,000,000 (PW: MMK 17,900,000)

Source: JICA Study Team

Appendix 1.11 Monitoring Plan

Table A1.35 Monitoring Plan

Category	Environmental Item	Monitoring Indicator	Monitoring/ Measurement Point/ Place	Monitoring Method	Frequency (Period)	Implementing Organization	Responsible Organization	Cost (in MMK) Burdened by the Organization
Planning Stage								
Natural Environment	Trees (including flame tree)	Conditions of trees after removal/ transplanting	The place where the tree was replanted.	Visual observation	4 times/year (1.5 year after removal /transplanting)	PW YCDC -PPGD	PW YCDC -PPGD	PW*
Construction Stage								
Social Environment	- Temporal closure of roads, one-way reduction and speed limit in construction -Other traffic problems	Occurrence of inconvenience for inhabitants to move or access to infrastructure services -Other traffic problem	Around the access roads	Visual observation Hearing with inhabitants	Daily (During construction)	Contractor	PW Contractor	Contractor**
	Public health and sanitation	Symptom of inhabitants Diagnostic tests by doctor	-Related offices -Residences of inhabitants	Hearing with YCDC, Township government and inhabitants	Once/month (During construction)	Contractor	PW Contractor	Contractor**
	Infectious diseases such as HIV/AID	Number of HIV-positive	Related YCDC office	Hearing with related YCDC office	Once/month (During construction)	Contractor	PW Contractor	Contractor**
	Accidents	Traffic accidents	Related YCDC office	Hearing with related YCDC office	Daily: when an accident occur (During construction)	Contractor	PW Contractor	Contractor**
Natural Environment	Hydrological situation	-Change of river stream - Change of river bank	Around the new bridge	Visual observation of river flow and the river bank	Once/month (During construction)	PW	PW	PW*
Environmental	Air quality	Quantitative	Two points near	On-site reading	3 times/year: dry	Local	PW	PW

Category	Environmental Item	Monitoring Indicator	Monitoring/ Measurement Point/ Place	Monitoring Method	Frequency (Period)	Implementing Organization	Responsible Organization	Cost (in MMK) Burdened by the Organization
Pollution		measurement SO_2 NO_2 PM10 PM2.5	the planned access road area (twice/each measurement)		season (During construction)	consultant (measurement)		9 times measurement MMK 14,700,000
		Qualitative monitoring Severity of air pollution	Residence of the resident reporting the complaint.	Hearing with residents	Daily: When a complaint is reported. (During construction)	Contractor	PW Contractor	Contractor**
	Water quality	Quantitative measurement pH SS DO BOD_5 Turbidity	Two points downstream of the bridge (surface layer, bottom layer)	Standard sensor/ Analyzer Digital turbidity meter	3 times/year: dry season (During construction)	Local consultant (measurement)	PW	PW 9 times measurement MMK 15,300,000
		Qualitative monitoring Turbidity of water	Residence of the resident reporting the complaint	-Hearing with Residents -Visual observation	Daily: When a complaint is reported. (During construction)	Contractor	PW Contractor	Contractor**
	Noise	Quantitative measurement Noise	Two points same as air quality (twice/each measurement)	Sound level meter	3 times/year: dry season (During construction period)	Local consultant (measurement)	PW	PW 9 times measurement MMK 13,500,000
		Qualitative monitoring Severity of noise and vibration	Residence of the resident reporting the complaint	Hearing with residents	Daily: When a complaint is reported. (During construction)	Contractor	PW Contractor	Contractor**

Category	Environmental Item	Monitoring Indicator	Monitoring/ Measurement Point/ Place	Monitoring Method	Frequency (Period)	Implementing Organization	Responsible Organization	Cost (in MMK) Burdened by the Organization
	Waste	Construction waste General daily waste	Construction site Worker's camp	Visual observation Conditions of discharge and treatment of waste	Daily in principle: particularly important when complaint is reported. (During construction period)	Contractor	Contractor	Contractor**
Operation Stage								
Social Environment	Public health and sanitation	Symptoms of inhabitants Diagnostic tests by doctor	-Related offices and residences -Residences of inhabitants	Hearing with YCDC, Township government and inhabitants	Once/month (1 year after beginning of operation)	PW	PW	PW*
	Accidents	Traffic accidents	Related YCDC office	Hearing with related YCDC office	Weekly: when an accident occur (1 year after beginning of operation)	PW	PW	PW*
Environmental Pollution	Air quality	Quantitative measurement SO_2 NO_2 PM10 PM2.5	Two points near the planned access road area (twice/each measurement)	On site reading	3 times/year: dry season (1 year after beginning of operation)	Local consultant (measurement)	PW	PW 3 times measurement MMK 4,900,000 thousand
	Noise	Quantitative measurement Noise	Two points same as air quality (twice/each measurement)	Sound level meter	3 times/year: dry season (1 year after beginning of operation)	Local consultant (measurement)	PW	PW 3 times measurement MMK 4,500,000
							Total Cost	MMK 52,900,000

Source: JICA Study Team (Note) *: PW: Within project general administration cost
**: Contractor: Within construction management cost

Method of Quantitative Monitoring/Measurement for Environmental Pollution Items

Table A1.36, Table A1.37 and Table A1.38 show the method of quantitative monitoring/measurement of air quality, noise, and water quality, respectively.

Table A1.36 Method of Quantitative Monitoring/Measurement of Air Quality

Item	1-1	Measurement Method	Referred International Standards	
			Japan's Environmental Standards	WHO Guidelines
SO_2	ppm	On-site reading	Daily average less or equal 0.04	Daily average less or equal 0.02
CO	ppm	On-site reading	Daily average less or equal 10	-
NO_2	ppm	On-site reading	Daily average less or equal 0.04～0.06 or less than that	Yearly average less or equal 0.04
PM10	ppm	On-site reading	Daily average less or equal 0.10	Daily average less or equal 0.05
PM2.5	μ g/m^3	On-site reading	Daily average less or equal 35	Daily average less or equal 25

(Note) *: "Environment Standard for Air Pollution" (1973, Standard for $PM_{2.5}$: 2009)
**: WHO "Air Quality Guidelines – Global Update 2005"
Source: JICA Study Team

Table A1.37 Method of Quantitative Monitoring/Measurement of Noise

Unit	Measurement Method	Referred International Standards			
		Japan Environmental Standard*		WHO Guidelines**	
dB	Sound level meter	Daytime	65	24 hours	70
		Nighttime	60		

(Note) * : "Standard of Ambient Noise" (1998)
- Category of area: Area C (Area to be used for commercial use, industrial use, etc., together with a considerable number of residences)
- Division of time : Daytime 6:00 a.m. – 10:00 p.m., and nighttime 10:00 p.m. - 6:00 a.m.
- Division of area: Area facing the road with lanes within Area C

** : WHO "Guideline values for community noise in specific environment" (1999)
- Industrial area, commercial area, roadside, indoor /outdoor

Source: JICA Study Team

Table A1.38 Method of Quantitative Monitoring/Measurement of Water Quality

Item	**Unit**	Measurement Method	Referred International Standards
			Japan's River Water Quality Standards for Public Usage* Category D**
pH	-	pH Sensor	6.0 - 8.5
SS (Suspended Solids)	mg/L	Gravimetric method	Less or equal 100
DO (Dissolved Oxygen)	mg/L	DO Sensor	More or equal 2
BOD_5 (Biochemical Oxygen Demand)	mg/L	Direct inoculation method	Less or equal 8
Turbidity	NTU***	Digital turbidity meter	-

(Note) *: "Environmental Standard for Water Pollution"
#2 Water quality standard for conservation of living environment (1971)
** : Category D : Industrial Water Grade 2 (special water purification is operated), Agricultural Water and Conservation of Environment
***: If turbidity was measured as FNU, data shall be reduced to NTU.
Source: JICA Study Team

Appendix 1.12 Minutes of the Stakeholders Meeting

The agenda of the meeting is shown below.

1. Opening remarks by Mr. Han Soe, Deputy Managing Director, Public Works, Ministry of Construction
2. Opening speech including introduction of the project by Mr. Soe Min, Chief Engineer, Public Works, Ministry of Construction
3. Presentation of outline of the project by a consultant of the JICA Study Team.
4. Presentation of the environmental and social considerations of the project by the same consultant above.
5. Open question and answer session
6. Closing remarks by Mr. Soe Min, Chief Engineer, Public Works, Ministry of Construction

<<Question and answer>> (Note) 1. Q : question, A : answer

Q (Ward administrator)
Is Sutaung Pyae Pagoda compound included in the affected area of the project?
A (Consultant of the JICA Study Team)
The Pagoda is not included in the affected area.

Q (From the automobile repair workshop)
Will the bridge construction work affect the workshops and stalls in the Mingalar Tuang Nyunt side? Can customers' cars enter during the construction activities?

A	(Consultant) Only one car workshop will be affected by the construction work. (Mr. Soe Min, Chief Engineer, PW) The workshops will not be affected by the construction work which will start from 2015 except for one located at the right side of the access road. The workshops located at the left side will be affected when the approach road construction/widening will start.
Q	(From the car aircon shop) Is my shop affected?
A	(Chief Engineer, PW) PW is trying to get international support funds for the construction of approaching roads. If the construction of four-lane approach roads could be started, the area will be affected.
Q	(Union Solidarity and Development Association : USDA) The land of four affected shops (tea shop, beauty parlour, games and mobile top-up) are rented from the USDA. Would like to know whether USDA will be affected by the project or not. Actually, the land area is a government land and rented from the government.
A	(Consultant) In case your business or company will be affected. These shops' structures will just be affected in small part during construction. It is possible to move the structure a little bit backward. The matter of relocation of these structures should be discussed with the Public Works.
Q	(From the tea shop) The land, where my shop is placed, is being rented from USDA with monthly rental fees, and the structure was built by my own expense. If it is necessary to remove my shop and need to be relocated to other place, I would like to know the procedures and arrangements.
A	(Chief Engineer, PW) When the structure relocation is taking place, two options are offered, i.e.,rebuilding the structure by moving it a little bit to the front side or the other option is supported by compensation to the affected people. Anyway, these will be arranged in the relocation procedure in order to finish it nicely.
Q	(Lawyer, Stall owner) I'd like to know whether my beverage and snacks shop is free from the project or not?
A	(Chief Engineer, PW) The shop is free from the project area.
Q	(Chairman, Buddhist Cooking Structure) Now, we know in the meeting that the Buddhist cooking structure is affected by the project and needs to rebuild in a new place. In that case, we want to propose the location between Pathein Myae 3rd Street and 4th Street.
A	(Chief Engineer, PW and the consultant) We will record your proposal and the Public Works will try to manage that matter by discussing it with YCDC.

Appendix 1.13 Comparative Consideration of Alternatives

Environmental and social considerations are one of the criteria in the planning of access roads . One of the subjects in planning is the slope works for the road, the main point of comparative consideration is the slope works for the road. Results of the comparative consideration is shown in Table A1.39. Since the side of the road is vertical retaining wall, closing of community road can be avoided and outflow of soil can prevented

Table A1.39 Comparative Consideration of Slope Works for the Access Road

Criteria	Alternative 1 Embankment Slope	Alternative 2 Concrete Wall （Inverted T-Type）	Alternative 3 Reinforced Earth Wall
Impact on the community road	Community road will be closed partly.	Closing of community road can be avoided.	Closing of community road can be avoided.
Soft soil treatment	Area requiring soft soil treatment will be large.	Area requiring soft soil treatment will be small.	Area requiring soft soil treatment will be small.
Constructability	Can be constructed without any critical problem. Area of traffic restriction will be large.	Can be constructed without any critical problem. Area of traffic restriction will be small.	Can be constructed without any critical problem. Area of traffic restriction will be small.
Economic aspect	Most costly. Construction cost: 1.36	More costly than Option 3. Construction cost: 1.04	Most economical. Construction cost: 1.00
Overall Evaluation	Poor	Fair	Good

Source: JICA Study Team

Appendix 1.14 Policy of JICA

1) Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
2) When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
3) People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
4) Compensation must be based on the full replacement cost as much as possible.
5) Compensation and other kinds of assistance must be provided prior to displacement.
6) In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
7) Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
8) Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principles are complemented by the World Bank OP 4.12, since it is stated in the JICA Guidelines that “JICA confirms that projects do not deviate significantly from the World Bank’s Safeguard Policies.” Additional key principles based on World Bank OP 4.12 are as follows.

9) Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers and others who wish to take advance of such benefits.
10) Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to

land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.

11) Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

12) Provide support for the transition period (between displacement and livelihood restoration).

13) Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.

14) For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

Appendix 1.15 Entitlement Matrix

Table A1.40 shows Entitlement Matrix for Structures Replacement and Resettlement of the Project. All of the affected lands are owned by the governmental institutions. Thus, their compensations are not considered in this ARP.

Table A1.40 Entitlement Matrix

Type of Losses	Application	Entitled Person	Compensation	Responsible Organization
Loss of structures	Permanent loss of structures	Owner of structure with/without ownership identification	-Provide cash compensation at replacement cost which equals the market cost of materials used to build a replacement structure, with cost of transporting building materials to construction site, cost of any labor, contractors' fees, and cost of any registration and transfer taxes	PW (as the compensation contractor /payer) YCDC (as the land owner)
Loss of income source	Temporary loss of income source	Owner of business	-Provide cash compensation as one (1) month sale -Owners of business provide their affected workers with one (1) month income from the compensation as one (1) month sale	PW
	Temporary loss of income source	Worker in business	-Provide cash compensation as one (1) month income -Workers receive the compensation as one (1) month income from their owners' compensation	PW
-	Transition/moving support	All PAHs (business owners' households)	-Provide cash compensation as 100,000 MMK to each PAH	PW

Source: JICA Study Team

Appendix 1.16 Grievance Redress Mechanism

(1) Constitutional grievance redress mechanism

-The constitutional basis of activities relating grievances is Land Acquisition Act (1894).

-Article 23 of the Act stipulates that in determining the amount of compensation to be awarded for land acquired under this Act, the Court shall take into consideration: The damage (if any) sustained by the person interested, at the time of the Collector's taking possession of the land, by reason of the acquisition injuriously affecting his other property, moveable or immoveable, in any other manner, or his earnings.

-Accordingly, Grievance redress mechanism stipulated in the Act can be applicable to grievance relating to compensation for loss of structures or income.

If deliberation reaches agreement, Award Committee issues the decision concerning type and amount of compensation. If not reach agreement, the deliberation is continued until reach agreement. If the affected people and Award Committee cannot conclude with the further deliberation meeting, GAD can intermediate between them. Besides, Land Acquisition Act Article 18 stipulates as follows.

Any person interested in the land who do not accept the award may, by written application to the Collector, require that the matter be referred by the Collector for the determination of the Court, whether his objection be to the measurement of the land, the amount of the compensation, the person to whom it is payable, or the apportionment of the compensation among the persons interested.

(2) Grievance redress system for the Project

The basic point of Grievance redress system for the Project is as follows.

a. To establish an accessible, fair and transparent grievance redress system by the basis of JICA Guidelines and Land Acquisition Act of Myanmar.
b. The expenses relating to grievance redress activities burden on PW.
c. PW will maintain an ongoing interaction with PAPs to identify problems and will undertake appropriate remedial measures.

   For this purpose PW will put the person in charge of grievance redress (Grievance redress officer: GRO).

   -GRO shall be easily accessible for PAPs by oral or verbal communication.

   -It is important that GRO always presents in the PW office during the process of structures replacement and resettlement, and addresses any queries, disputes and complains that may arise.

   -Determination in correspondence should be given as soon as possible when after receiving any grievances.

   -GRO must records all complains and respective actions.

d. For issues that cannot be processed by GRO, the officer requests the correspondence and the resolution to ARP supervising manager (PW), Yangon Regional Government, YCDC and Officer of GAD, in accordance with the Land Acquisition Act.

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Table A1.41 shows Organizations with Role in Grievance redress system.

Table A1.41 Organizations with Role in Grievance redress system

Organization		Role	Note
PW	GRO	To improve accessibility and openness for PAPs	-Initial contact point from PAPs -Utilize oral communication effectively
	ARP supervising manager	To treat a problem that is difficult to be solved by GRO	-Usually official letter is used to notice the decision or approval
Yangon Regional Government		Role as the top-level determination and consultative organization in Yangon area relating to public land matter	-Support PW by advice or consultation
YCDC		Role as the local government possessing public land	-Support PW by advice or consultation
GAD (presiding ministry: Ministry of Home affairs)		-Role as the local level authority for Land Acquisition Act -Role as the legal authority of local level land administration	-Support PW by advice or consultation -In the case that PAPs and PW cannot reach agreement, GAD will intermediate between them.

Source: JICA Study Team

Appendix 1.17 Framework for Implementation

Organizations with responsibility and duty for structures replacement and resettlement in the Project are shown in Table A1.42

Table A1.42 Organizations with responsibility and duty for structures replacement and resettlement

Organization	Role	Description of responsibility and duty
MOC	Role as the line Ministry of PW	-Approval of Structures replacement and Resettlement in the Project
PW	Role as the proponent	-Identifying data of Structures replacement and Resettlement -Forming and managing Compensation Committee -Close communication with PAPs, YCDC, GAD -Adequate Response for grievance from PAPs with ongoing interaction -Payment of compensation -Support of livelihood of PAPs during transition period
YCDC	Role as the responsible local government relating to Structures replacement and Resettlement	-Support to arrange relocation or reconstruction place -Support to decide compensation rate

Organization	Role	Description of responsibility and duty
Yangon Regional Government	Role as the responsible local government relating public land matter	-Guide and support public land matter relating compensation -Support to decide compensation rate
GAD	Role as the leading authority of Land Acquisition Act	-Guide or recommendations for the procedures of Structures replacement and Resettlement in the Project, based on the Land Acquisition act and case experiences in GAD. -Support to decide compensation rate -In the case that PAPs and PW cannot reach agreement, GAD will intermediate between them.

Source: JICA Study Team

Appendix 1.18 Implementation Schedule

Table A1. 43 shows ARP implementation schedule.

Table A1.43 ARP implementation schedule

Item	2014 May	June	July	Aug	Sep	Oct	Nov	Dec
Building up ARP Implementation System, Initiation of Action	△							
Finalization of Draft ARP by PW	△							
Forming the Compensation Committee	△							
Operation of the Committee								
Grievances redress								
Fixation of compensation amount Paying compensation (sequential processing)								
Finalization of revised ARP						△		
All PAPs agree with compensation agreement.						△		
Completion of Procedure for Compensation and Resettlement							△	
Monitoring of PAPs								

Source: JICA Study Team

For two years after the completion of physical displacement

Appendix 1.19 Estimated Costs and Source of Funds

The compensation amount is estimated based on the entitlement matrix (Table A1.40). The composition and the way of estimation of the compensation are shown as follows.

1) Replacement cost of structures: apply estimation method of PW. Do not take into account depreciation of the asset and value of salvage materials.

2) Transition/moving support: 100,000 MMK for each owner (7 owners of workshop/ shop).

3) Compensation to loss of income source: one month sale/income of each PAH.

Table A2.44 shows the compensation amount estimated provisionally.

Actual compensation amount will be considered and determined by PW and Compensation Committee based on the detailed data such as latest market prices of construction materials, reviewed monthly sale of each shop, etc..

Table A1.44 Estimated Costs of Compensation(Unit: MMK in thousands)

Reconstruction cost of structure	Transition/Moving support	Compensation to loss of income source	Total
7,106	700	7,607	15,413

Source: JICA Study Team

Based on estimated compensation amount, Table A1.45 shows the estimated budget of PW for structures replacement and resettlement.

Table A1.45 Estimated Budget of Structure Relocation and Resettlement

No.	Description	Unit	Quantity	Rate (thousand MMK /Unit)	Amount (thousand MMK)
1	Compensation cost (A)	Lump sum	1	15,413	15,413
2	Miscellaneous compensation relating cost (registration tax, remittance, etc.)	5% of (A)			771
3	Activities direct cost (transportation, Office supplies, etc.)	Lump sum	1	900	900
Subtotal (B)					17,084
4	General and administrative cost & Contingency (C)	15% of (B)			2,563
Total (B)+(C)					19,647

Source: JICA Study Team

Appendix 1.20 Monitoring (Structures Replacement and Resettlement)

Monitoring is carried out by internal monitoring and external monitoring.

Internal monitoring is implemented by PW.

External monitoring is implemented by independent party such as local/international consultants, NGO or university.

(1) Monitoring Plan

1) Internal monitoring

Table A1.46 shows Monitoring Plan of Internal monitoring.

Table A1.46 Monitoring Plan (Internal monitoring)

Monitoring Item	Monitoring Indicator	Period	Frequency	Responsible Organization
Planning /Pre-construction Stage				
Compensation	Number of PAHs/PAPs who have received full amount of compensation	from May 2014 to Apr. 2015 (starting time of construction)	Once /month	PW (as the compensation contractor /payer)

Monitoring Item	Monitoring Indicator	Period	Frequency	Responsible Organization
Structure Replacement	Number of structures which have been cleared	from May 2014 to Apr. 2015 (starting time of construction)	Once /month	PW YCDC (as the land owner)
Resettlement	Number of PAHs/PAPs who have resettled	from May 2014 to Apr. 2015 (starting time of construction)	Once /month	PW YCDC
Record/Perception of Grievance	-The presence or absence of grievance -Contents of grievance - Response to grievance -Redress -Results	from May 2014 to Apr. 2015 (starting time of construction)	Whenever a complaint occurs	PW
Construction /Operation Stage				
Record/Perception of Grievance	-The presence or absence of grievance -Contents of grievance - Response to grievance -Redress -Results	for two years after the completion of physical displacement	Whenever a complaint occurs (from the beginning of construction)	PW
Level of livelihood	-Occupation (with comment of change or not changed) -Monthly sales /income (amount, MMK) –Household level (qualitative survey)	for two years after the completion of physical displacement	4 times/year	PW

Note: Monitoring Method: Hearing from PAPs

Source: JICA Study Team

2) External monitoring

External monitoring is carried out periodically by an independent party to review and evaluate implementation of replacement and resettlement.

External monitoring should be done as such way as follows.

(a) To obtain objective monitoring data by an independent party.

(b) Not limited to mere data collection, qualitative analysis for such matters as shown below is required.

-Whether the internal monitoring result is reasonable compared with initial plan.

-Whether internal monitoring result is proper compared with the original plan of monitoring.

-Comparing with the contents of compensation and livelihood level of PAPs, whether anything is required for improvement in assistance.

-Whether grievance redress system is appropriate.

Table A1.47 shows Monitoring Plan of External monitoring

Table A1.47 Monitoring Plan (External monitoring)

Monitoring Item	Indicators	Period	Frequency
Plan/Schedule	-The difference/ delay of replacement/ resettlement activities compared to the planned schedule. -The difference/ delay of compensation payment compared to the planned compensation and schedule.	from May 2014 to Apr. 2015 (starting time of construction)	2 times
Level of livelihood	-Occupation (with comment of change or not changed) -Monthly sales /income (amount, MMK) –Household level (qualitative survey)	for two years after the completion of physical displacement	3 times/year

Source: JICA Study Team

(2) Monitoring Form

1) Internal monitoring

Table A1.48 shows Monitoring Form of the internal monitoring.

Table A1.48 Monitoring Form (Internal monitoring)

	Original Number of PAHs/PAPs and Affected Structures	Monitoring Indicator	Period (from dd/mm/yyyy to dd/mm/yyyy) /date	Results	
				-Qualitative Data -Quantitative Data (with date)	-Remarks -Comments (with date)
Planning /Pre-construction Stage					
Compensation	7 workshop/ shop owners, 33 employees (PAPs)	Number of PAHs/PAPs who have received full amount of compensation			
Structure Replacement	5 structures	Number of structures which have been cleared			
Resettlement	1 PAH, 4 employees (PAPs)	Number of PAHs/PAPs who have resettled			

	Original Number of PAHs/PAPs and Affected Structures	Monitoring Indicator	Period (from dd/mm/yyyy to dd/mm/yyyy) /date	Results	
				-Qualitative Data -Quantitative Data (with date)	-Remarks -Comments (with date)
Record /Perception of Grievance	-	-The presence or absence of grievance -Contents of grievance -Response to grievance -Redress -Results			
Construction /Operation Stage					
Record /Perception of Grievance	-	-The presence or absence of grievance -Contents of grievance -Response to grievance -Redress -Results			
Level of livelihood	7 PAHs, 33 employees (PAPs)	-Occupation (with comment of change or not changed) -Monthly sales /Income (amount, MMK) -Household level (qualitative survey)			

Source: JICA Study Team

2) External monitoring

Table A1.49 shows Monitoring Form of the external monitoring.

Table A1.49 Monitoring Form (External monitoring)

	Original Number of PAHs/PAPs and Affected Structures	Monitoring Indicator	Period (from dd/mm/yyyy to dd/mm/yyyy) /date	Results	
				-Qualitative Data -Quantitative Data (with date)	-Remarks -Comments based on qualitative analysis (with date)
Plan/Schedule	7 workshop/ shop owners, 33 employees (PAPs)	-The difference/delay of replacement			

	Original Number of PAHs/PAPs and Affected Structures	Monitoring Indicator	Period (from dd/mm/yyyy to dd/mm/yyyy) /date	Results	
				-Qualitative Data -Quantitative Data (with date)	-Remarks -Comments based on qualitative analysis (with date)
		/resettlement activities compared to the planned schedule. -The difference/delay of compensation payment compared to the planned compensation and schedule.			
Level of livelihood	7 PAHs, 33 employees (PAPs)	-Occupation (with comment of change or not changed) -Monthly sales /Income (amount, MMK) -Household level (qualitative survey)			

Source: JICA Study Team

Appendix 1.21 Monitoring Form (draft)

Table A1.50 shows Monitoring Form. (Monitoring Form of Structures Replacement and Resettlement is shown in Table A1.48, A1.49.)

PW shall report the results of the Monitoring, biannually in principle, to local government (YCDC or Township: disclosure to inhabitants) and JICA Myanmar Office.

Table A1.50 Monitoring Form

Category	Environmental Item	Measurement Point	Period (from dd/mm/yyyy to dd/mm/yyyy)	Frequency	Results -Qualitative Data -Quantitative Measurement Data (Min, Max, Average)	Results -Comments -Responses/Actions to Comments and Guidance from the Public (with date)
Planning Stage						
Natural Environment	Trees					
Construction Stage						
Social Environment	-Temporal closure of roads, one-way reduction and speed limit in construction -Other traffic problem					
	Public health and sanitation					
	Infectious diseases such as HIV/AID					

Category	Environmental Item	Measurement Point	Period (from dd/mm/yyyy to dd/mm/yyyy)	Frequency	Results -Qualitative Data -Quantitative Measurement Data (Min, Max, Average)	Results -Comments -Responses/Actions to Comments and Guidance from the Public (with date)
	Accidents					
Natural Environment	Hydrological situation					
Environmental Pollution	Air quality					
	Quantitative measurement					
	Qualitative monitoring					
	Water quality					
	Quantitative measurement					
	Qualitative monitoring					
	Noise					
	Quantitative measurement					
	Qualitative Monitoring					
	Waste					

Category	Environmental Item	Measurement Point	Period (from dd/mm/yyyy to dd/mm/yyyy)	Frequency	Results -Qualitative Data -Quantitative Measurement Data (Min, Max, Average)	Results -Comments -Responses/Actions to Comments and Guidance from the Public (with date)
	Construction Waste					
	General daily waste					
Operation Stage						
Social Environment	Public health and sanitation					
	Accidents					
Environmental Pollution	Air quality Quantitative measurement					
	Noise Quantitative measurement			r		

Source: JICA Study Team

Appendix 1.22 JICA Environmental Checklist

(For Bridges, Roads and River/ Sand Erosion Control)

Table A1.51 Project for the Construction of New Thaketa Bridge

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
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) Category of the project is set as B by JICA, and IEE is being prepared. (b) IEE report will be submitted to the Ministry of Environment Conservation and Forestry (MOECAF) through the Myanmar Foreign Economic Relations Department: FERD (Ministry of National Planning and Economic Development). (Note) - Obligations of preparing the EIA report for projects are stipulated in the "Environmental Impact Assessment Procedures: EIA Procedures, draft)." - In the EIA Procedures, the following procedures are described: Screening of the project (which requires EIA or IEE), required conditions for EIA /IEE, contents, submission and approval, etc. - The EIA Procedures are still draft, as of March 2014, but begin to operate in actual recently. - For investment from abroad or foreign donor project, EIA Procedures are as follows: IEE/EIA report prepared by a consultant (not allowed by the proponent) (attached to the project proposal) >> Sector line ministry >> FERD of Ministry of National Planning and Economic Development >> Planning Department >> MOECAF will review and present the comments. MOECAF will approve after the response of the proponent. (c) With regard to the conditions on the approval of IEE report, PW will confirm before submission of IEE report. (d) Along with the confirmation of process (b) PW will confirm those matters.
	(2) Explanation to the Public	(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 comments from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) The stakeholders meeting was conducted on 22 March 2013. Appropriate explanation was made for the outline and environmental impacts of the project, including information disclosure was made. Local stakeholders understood well the explanation content. (b) The comments from the stakeholders have been reflected to the project content such as environmental and social considerations.

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) The following alternatives were examined including environmental and social perspective. -Zero option -Construction of two-lane new bridge upstream of the existing bridge -Current plan
2. Pollution Control	(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 mitigation measures taken? (b) If air quality already exceeds country's standards near the route, is there a possibility that the project will make air pollution worse?	(a) N (b) N	(a) Traffic volume is expected to be higher due to the construction of the new bridge. In some cases, temporary traffic congestion occurs in the vicinity. At the same time, vehicle traffic is smooth. As a consequence, emissions of air pollutants are expected to increase slightly or not the same as before the project. It is expected that negative impact of air pollution around the access roads will be small. (b) Currently, there is no environmental standard of ambient air quality in Myanmar. According to the actual measurement result, measurement values of air qualities near the access roads are within the range of the environmental standards of Japan and the WHO Guidelines.
	(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 surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as stations and parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas that do not comply with the country's ambient water quality standards?	(a) N (b) N (c) N/A	(a) Because the cross section structure of access roads is not on the slopes, but on vertical retaining wall, there is almost no cutting and filling activities. So, there is almost no possibility of soil runoff from the barren lands. (b) There is no water source, such as groundwater, in and around the project site. (c) Not applicable. (There are no facilities, such as stations and parking areas/ service areas in the project site.)
	(3) Noise and Vibration	(a) Do noise and vibrations from vehicle and train traffic comply with the country's standards?	(a) Y	(a) Traffic volume is expected to be higher due to the construction of the new bridge. In some cases temporary traffic congestion occurs in the vicinity. At the same time, vehicle traffic will be smooth. As a consequence, noise and vibration generated from vehicle traffic are expected to increase slightly or not the same as before the project. It is expected that adverse impact of noise and vibration around the access roads is small. Currently, there is no environmental standard of noise and vibration in Myanmar. According to the actual measurement results, measurement values of noise near the access roads are within the range of the environmental standards of Japan and the WHO Guidelines. (b) Not applicable.

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
		(b) Do low frequency sound from the vehicle and train traffic comply with the country's standards?	(b) N/A	It is assumed that the impact of low frequency sound by vehicle traffic is small as of the noise, but the actual measurement data does not exist at all. There is no standard for low frequency sound in Myanmar. A new measurement is also technically difficult in Myanmar.
	(4) Waste	(a) Are waste generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations? (b) In the case of that large volumes of excavated/dredged materials are generated, are the excavated/dredged materials properly treated and disposed of in accordance with the country's standards?	(a) N/A (b) N	(a) Not applicable. (There are no facilities, such as stations and parking areas/ service areas in the project site.) (b) Volumes of generated excavated/dredged materials are very small.
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) There is no protected area in and around the project site.
	(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?	(a) N (b) N (c) Y	(a) There are no primeval forests, tropical rain forests, and ecologically valuable habitats that the project site encompasses. There are no mangroves in the planned area. (b) -According to the biological and ecological survey in the project, two vulnerable species of the Red List of International Union for Conservation of Nature and Natural Resources (IUCN) were found in the survey area (in and around the project site). (i) *Delonix regia* (Bojer ex Hook. Raf.) (Seinban/ Flame tree) (ii) *Swietenia macrophylla* King (Mahogany tree). Vulnerable species means in the condition of less threatened than "critically endangered" or "endangered species" in the Red list. These two trees are found commonly at the parks or greeneries of the Yangon area. -According to the actual survey conducted after planning, area of access roads was determined, none of these two species above exist in the affected area. -There are a lot of trees (not rare species) exist in the Pproject affected area. (c) According to the instruction from the Forestry Department, MOECAF, removal or transplanting and/or alternative planting of trees, at first, has to submit the application letter including data of tree species, location, and numbers of trees, to the department to obtain its permission. In the project plan, these trees will be avoided in order not to remove them, etc. as much as possible. If it is unavoidable, actual activities (removal or transplanting and/or

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
		(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? (f) In cases where the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environment?	(d) N/A (e)N/A (f) NA	alternative planting) shall be required to YCDC- Playgrounds, Parks and Gardening Department (PPGD) with prescribed payment. (d) Because the project site is located in the developed urban area, the project does not cause impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock. (e) Not applicable. Because the project site is located in the developed urban area, the project does not cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems. (f) Not applicable. (The project site is not located in undeveloped areas.)
	(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) Alternation of land and installation of structures on the river bank are limited at the end of the bridge, and scale is not large. The installation of structures such as abutments and piers in the river, and scale is not large. These construction activities are expected to slightly affect the surface water and groundwater flows.
	(4) Topography and Geology	(a) Is there a 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) There is no slope land within the project site which causes slope failures or landslides. (b) Because the elevation structure of access roads is vertical retaining wall, there are almost no cutting and filling activities . (c) Because the structure of access roads is vertical retaining wall, there will be almost no cutting and filling activities. Most aggregates are taken from the existing borrow pit far from the project site. Accordingly, soil runoff occurs rarely from the project site.

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
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?	(a) Y	(a) Involuntary resettlement of four groups (seven persons) and replacement of seven units such as shop structures caused by the project implementation. Effort was made to reduce the impact as much as possible.
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	(b) Y	(b) Explanation on land acquisition and compensation was given to PAPs during the stakeholders meeting and direct communication.
		(c) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	(c) Y	(c) PW and study team shall conduct survey for resettlement and structure relocation. PW shall develop the abbreviated resettlement plan (ARP) that includes proper compensation, restoration of livelihoods and living standards developed based on socioeconomic survey on resettlement and structure relocation. Compensation should be made with full replacement costs, restoration of livelihoods and living standards.
		(d) Is the compensation going to be paid prior to the resettlement?	(d) Y	(d) The compensation shall be paid in cash by PW prior to land acquisition.
		(e) Are the compensation policies prepared in the document?	(e) Y	(e) The compensation policies was written on the explanation document of the stakeholders meeting and is written on the ARP.
		(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 peoples?	(f) Y	(f) The ARP will pay particular attention to vulnerable groups or people and indigenous peoples.
		(g) Are agreements with the affected people obtained prior to resettlement?	(g)Y	(g) Agreements with PAPs can be obtained prior to structures removal and resettlement.
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	(h)Y	(h) PW has established a team with necessary capacity and budget to implement the ARP. PW got the participation of relevant institutions in the Compensation Fixation Committee hosted by PW.
		(i) Are there any plans developed to monitor the impacts of resettlement?	(i) Y	(i) The monitoring plan for monitoring the livelihood of PAPs is developed by PW.
		(j) Is the grievance redress mechanism established?	(j) Y	(j) PW will create the position of the grievance redress officer in the team.

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
	(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?	(a) N	(a) The project is intended to build a four-lane bridge that is close to the upstream side of the existing bridge. There is no impact to the residents that will affect the existing means of transportation and the associated workers. There is also no possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment.
		(b) Is there any possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	(b) N	(b) There is no factor in the project activities that adversely affect the living conditions of inhabitants other than PAPs.
		(c) Is there any possibility that diseases, including communicable 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?	(c) Y	(c) In construction stage, there is the possibility that infectious diseases, such as HIV, will be brought due to the migration of construction workers. Mitigation measures are described in 5. Others (1) Impacts during Construction
		(d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increases of traffic congestion and traffic accidents)?	(d) Y	(d) There is no possibility that the project will adversely affect road traffic in the surrounding areas in the operation stage. However, there is a small possibility that traffic accidents will increase by transportation vehicles. Construction of the new bridge is expected to have positive impact in increasing the potential traffic volume and in dissolving current congestion problem.
		(e) Is there any possibility that bridge and access roads will impede the movement of inhabitants?	(e) N	(e) There is no possibility that bridge and access roads will impede the movement of inhabitants. The structure and alignment of the bridge and access roads are designed as being convenient for the movement of inhabitants.
		(f) Is there any possibility that bridges and access roads will cause a sun shading and radio interference?	(f) N	(f) Influence of the bridge and access roads on a sun shading radio interference seems to be minor, because the height of maximum elevation and vertical retaining wall of access roads is not so high.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There are no significant local archeological, historical, cultural, or religious heritage sites in and around the project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There is no landscape element to need special consideration. Since existing bridge and new bridge stand side by side for a period of time. However, There is not a particular landscape disharmony in the new and old bridges.

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	(a)Y	Considerations were given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples. (There is no activity within the project site that would particularly affect 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?	(b)Y	(b) All of the rights of ethnic minorities and indigenous peoples in relation to land and resources have been respected in the project. (No residential areas of ethnic minorities and indigenous peoples are observed in the project site.)
	(6) Working Conditions	(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?	(a)Y	(a) The contractor shall not violate Myanmar's regulations that cover working conditions, the welfare of workers, and safety and health.
		(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?	(b)Y	(b) During construction period, tangible safety considerations have taken place for individuals involved in the project. Tangible safety measures should be taken as follows: -Installation of safety equipment which prevents industrial accidents. - Physical zoning of safety work area.
		(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.?	(c)Y	(c) Intangible safety measures should be taken as follows: - The contractor should prepare safety and health management plan, including traffic safety, accident prevention and public sanitation, etc., according to the regulations related to working conditions. - The contractor should conduct educational training of safety, health and public sanitation to workers and staffs.
		(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?	(d)Y	(d) The contractor should implement proper and strict management and education of guards not to infringe safety and security of residents, staff, and workers.
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 waste)?	(a)Y	(a) a1) Noise and vibrations (generated by transportation vehicles/ vessels and heavy machines) - Maintenance of vehicles/ vessels and heavy machines is improved sufficiently and operate them on low-noise/ vibration condition. - If necessary, install soundproof fence or buffer zones. - Consideration and restriction of working time in the morning and at night. a2) Air pollution (caused by transportation vehicles/ vessels and heavy machines) - Vehicles/ vessels and heavy machines use good quality fuel and oil. - Consideration and restriction of working time in the morning and at night.

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
				a3) Water Pollution - High turbidity water shall not be discharged intensively at a time without waiting precipitation of sand and earth. Steel sheet pile method shall be effectively operated. - Transport vehicles, construction heavy machines shall be used so as not to leak oil. Waste oil is disposed safely in storage. a4) Waste - Construction waste and waste from worker's camp shall be collected, segregated properly, reused and recycled according to regulations and rules of YCDC. Then remained waste will be transferred to designated dumping site for final disposal. - The contractor shall provide education and enlightenment for above activities (decreasing quantity, segregation, reuse and recycling) to workers. - Remaining sand and soil should be backfilled in principle. - Waste which are not prescribed in the regulations and rules and could not be treated or disposed in areas, should be brought back by the contractor and treated and disposed appropriately according to the local government of the area where the waste are brought in.
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	(b)Y	(b) In the planned area of the access road, there are no rare plant and animal species such as species in the Red List of IUCN. However, a lot of trees exist in the planned area of the access roads. For removal or transplanting and/or alternative planting of trees necessary procedure shall be taken according to the regulation and instruction of the Forestry Department of MOECAF described in "3 Natural Environment, (2) Ecosystem".
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(c)Y	(c) c1) Road congestion and traffic access failure - Related public notice prior to temporary traffic restrictions - If necessary, time shift of activities of construction or operation of transport vehicles. c2) Public health and sanitation - Air contaminants, such as SPN, NOx, and SOx, will be exhausted from transport vehicles/ vessels and construction heavy machines. There is a slight possibility that respiratory diseases due to the air contaminants occur. But, mitigation measures such as limit of construction activities in the morning and at night and using low exhaust gas fuel for vehicles/ vessels and heavy machines shall be taken into consideration. -Mobile temporary toilets will be installed for construction workers. c3) There is the possibility that infectious diseases, such as HIV, will be brought due to the immigration of construction workers. Mitigation measures are as follows: - HIV education for construction workers and residents.

Category	Environmental Item	Main Check Items	Yes/ No	Confirmation of Environmental Considerations
				- Regional workers will be preferentially hired as much as possible. c4) Accidents (relating to transportation vehicles/ vessels and heavy machines or construction activities) - Notify the construction plan (details of construction works, schedule, and place) to the residents of the areas around the construction sites. - Putting up a notice about the details above on the roadside. - Clarification of the boundaries of the construction areas with rope, fences, and other means.
	(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? (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?	(a)Y (b)Y (c)Y (d)Y	(a) PW developed the monitoring program by obtaining the support of the JICA Study Team. PW will implement the program run from the start of the construction works. (b) In the monitoring program, the items, methods, and frequencies and other relevant details are clearly described. (c) PW will establish the monitoring framework (team, responsible person, budget, etc.). (d) PW will develop the monitoring (including frequency of reports from and to the regulatory authorities).
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)Y (b) N/A	(a) Because the project is subject to the construction of bridge and access roads, adding to bridge checklist, pertinent items described in the Roads and River/ Sand Erosion Control are also checked. Items described in the Railways and Forestry are 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) Y	(a) Since emission of greenhouse gases such as CO_2 from transportation vehicles and heavy machines used in construction works are quite little and temporary, the impacts to transboundary or global issues are estimated to be negligible.

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 the 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 the project is located.

Appendix 1.23 Scoping and TOR of Surveys on Environmental and Social Considerations for the Project of Myanmar's Portion

(1) Scoping

Expected impacts were assessed and summarized as scoping with the evaluation of the extent of impacts and reasons.

Table A1.52 shows the results of the scoping.

Table A1.52 Results of the Scoping

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage I / II	Stage III	
Social Environment	1	Land acquisition and involuntary resettlement	B-		<Planning Stage> -It is necessary to relocate seven automobile repair workshops and automobile related shops in the north side of the bridge. -Involuntary resettlement of employees and owners/families of these workshops partly occur. -In addition, there is a possibility that relocation of one stall will occur. - -Slight portion of the land of the Hindu temple (north side of Upper Pazundaung Road) is included in the affected area. As regards to the acquisition, PW has already consulted with the temple leaders. -Land required by the project, except the land of the temple, are all publicly owned.
				D	No impact is expected.
	2	Poor people	D		<Planning Stage> There is no poor people in the planned area.
				B+	By the new road and improved access roads, even the poor are expected to access social services such as schools, hospitals, and markets easily.
	3	Indigenous people or ethnic minority	D	D	Neither indigenous people nor ethnic minority group is found in the planned area.
	4	Local economy such as employment and livelihood, etc.	C+		<Construction Stage> Even temporary, beneficial impact is expected with the creation of employment opportunities for construction workers.
				B+	By the four-lane traffic system of the entire bridge and roads, traffic access will be upgraded, and the existing traffic congestion will be eliminated. Since transportation and logistics situation is improved, positive effect can be expected according to the improvement of the local economy.
	5	Utilization of land and local resources	C		<Construction Stage> Construction materials (stone, gravel, and soil) used for construction are expected not to be obtained from the project site, but from a location far away from the project site. However, that is to be confirmed by the plan of construction.
				D	Impact is not expected, because agriculture and forestry are not performed in and around the project site.
	6	Water usage	D		<Construction Stage> There may be no impact on regional water use, because water for construction is from the public water supply.
				D	Impact is not expected
	7	Existing social infrastructures and services	B-		<Construction Stage> -There is no permanent closure of the existing bridge and roads. However, temporal and partial closure of roads or traffic control may occur. Therefore, there is a possibility of some inconvenience, such as

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage I / II	Stage III	
					traffic congestion and reduction of accessibility to public facilities. -Within the planned area of the bridge and access roads there are 66 electric poles (including small light poles, etc.), and those are necessary to be relocated. -Since there is a possibility that facilities and lines of social infrastructure other than electric poles (communications, water, sewerage, etc.) exist on the ground and underground of the planned area of the new bridge and access roads. Confirmation is necessary with related agency.
				B+	Transportation infrastructure is improved by the project and access to social service facilities in the region is improved.
	8	Social institutions such as social infrastructure and local decision making institutions	D	D	Since the project is mainly the widening of the approach roads, there is almost no impact on the social institutions such as decision making.
	9	Misdistribution of benefits and damages	C-		It is expected that there is almost no possibility of misdistribution of benefits and damages through the execution of the project. However, with regard to the impact by the widening of roads, rebuilding of flyovers, and demolition of the bridge, if the explanation to the residents and to the local authorities is insufficient, misdistribution of benefits and damages is possible to occur.
				D	Impact is not expected
	10	Local conflict of interests	D	D	Since the project is mainly the widening of the approach roads, the project itself is expected not to cause a conflict of interest in the region.
	11	Cultural, historical, archaeological and religious heritage site	D	D	In the project site, there are no valuable cultural, historical, archaeological structures and religious heritage sites.
	12	Water rights, fishing rights and rights of common	B-		-Water rights and fishing rights are not set in the river around the project area. -No rights of common in the peripheral forest around the project site are established. -Since bank area of the river is the controlled area of the MPA. During demolition of the existing bridge, if the land under control of MPA is necessary to be used, permission by MPA shall be required.
				D	Impact is not expected
	13	Landscape	D		Current state landscape may be impaired during construction. However that is temporary and partial.
				D	No impact is expected.
	14	Gender	D	D	No impact is expected.
	15	Rights of children	D	D	No impact is expected.
	16	Public health and sanitation	C-		<Construction Stage> Though the impact is temporary, air pollutants such as dust, SPM, NOx, and SOx emitted from construction vehicles and construction heavy machines/works may cause some adverse effect to respiratory organs.
				D	Air pollution due to increase in traffic volume may cause some adverse effect to respiratory organs. However, since vehicle travel will become smooth, the possibility is expected to be slight.
	17	Infectious	B-		<Construction Stage>

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage Ⅰ / Ⅱ	Stage Ⅲ	
		diseases such as HIV/AIDS			Construction workers and truck drivers are considered potential source in spreading infectious diseases such as HIV/AIDS by contacting with local women.
				D	No impact is expected.
	18	Working condition (including occupational health)	C-		<Construction Stage> There is a possibility that the health and occupational safety of the workers may be jeopardized depending on the conditions.
				D	No impact is expected.
	19	Accidents	B-		<Construction Stage> -It is expected that accidents occur due to construction vehicles, heavy machines and traffic congestion. -There is a possibility of accidents during bridge demolition work (on land and water) and during rebuilding of flyovers (railway, road).
				C-	There is a possibility of increased traffic accidents due to increase in traffic volume and speed.
	20	Global warming/ climate change	D		<Construction Stage> Generation of greenhouse gases is expected due to construction vehicles/vessels and heavy machines. However, extent of impact on climate change and cross-border are expected to be negligible small.
				D	Increase in emission of greenhouse gases is expected due to increase in traffic volume. However, extent of impact is expected to negligible small.
	21	Electromagnetic interference	D	D	There is a possibility that electromagnetic interference occurs. However, the possibility is quite small, since affected residences and building structures are few around the planned area.
Natural Environment	22	Protected area	D	D	There are no designated areas, such as protected area in and around the project site.
	23	Terrestrial fauna, flora and ecosystem	B-		<Planning Stage / Construction Stage> -According to the actual preliminary survey, two vulnerable species (tree) of the Red List of IUCN were found in the planned area. (i) Seven trees of *Delonix regia* (Bojer ex Hook. Raf.) (Seinban/ Flame tree) (ii) One tree of *Swietenia macrophylla* King (Mahogany tree) Flame tree and Mahogany tree are commonly found at the parks or greeneries of the Yangon area. - According to the actual preliminary survey, no rare terrestrial animals are found in the planned area. -There exist a considerable number of trees in the planned area, though those are not rare species. -According to instruction from the Forestry Department of MOECAF, for removal or transplanting and/or alternative planting of trees, it is necessary to submit an application document including data of tree species, location, and number of trees, to the department and is necessary to obtain its approval. -Actual action of removal or transplanting and/or alternative planting of trees is requested to YCDC-PPGD with payment as prescribed.
				D	No impact is expected.
	24	Aquatic fauna, flora, and ecosystem	B-		<Planning Stage / Construction Stage> -According to the actual preliminary survey, no rare aquatic organisms are found in the planned area. -However, during demolition work of the existing bridge, aquatic organisms may be affected.
				D	No impact is expected.

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage I / II	Stage III	
	25	Hydrological situation	C-		<Construction Stage> There is a possibility that hydrological situation may be changed during demolition of existing bridge, but it is temporary.
				D	Since the existing bridges is demolished, hydrological situation will return to the state similar to as before construction of the new bridge.
	26	Topography and geology	C-		<Construction Stage> Construction in the project does not involve large-scale land alteration.
				D	No impact is expected.
	27	Soil erosion	D		<Construction Stage> Since the scale of land cutting works is small, risk of soil erosion is slight.
				D	No impact is expected.
	28	Groundwater	D		<Construction Stage> It is not expected that pumping of groundwater will be uded in the construction.
				D	No impact is expected.
Environmental	29	Air pollution	B-		<Construction Stage> -Operation of transportation vehicles and heavy machines during the peak time or slow traffic time, the temporal deterioration of air quality is expected. -Power for construction work is due to the power generally supplied to the area. However, for blower or pump power generator by diesel fuel is also used, and it is expected that air pollutants such as NOx and PM are exhausted. -There is a possibility that air pollutants may be emitted during demolition of the existing bridge and rebuilding of flyovers (railway, road).
				C	-Depending on the degree of the increase in traffic volume, negative impact on air quality, due to emission gas (PM, NOx, etc.) from vehicles is expected. -On the other hand, by ease of traffic congestion and low running/idling, there is a possibility to reduce air pollution. -Air pollutants may be emitted during demolition of the existing bridge and rebuilding of flyovers (railway, road).
	30	Water pollution	B-		<Construction Stage> -Water pollutants from construction site, construction vehicles/vessels, heavy machines and worker's lodgment may be generated -Various water pollutants may be generated during demolition of the existing bridge. -Turbid water may be generated from rolling up mud by excavation and dredging work in the riverbed.
				D	No impact is expected.
	31	Soil contamination	B-		<Construction Stage> There is a possibility of soil contamination caused by discharging of pollutants or oils from construction site, transporting vehicles and heavy machines.
				C	If herbicides are used for the maintenance of road shoulders, there is a possibility of soil contamination.
	32	Bottom sediment	B-		<Construction Stage> Sediment pollution by disturbance of bottom mud and sedimentation /accumulation of pollutants generated during demolition of the existing bridge may be generated.
				D	No impact is expected.

Environmental Item			Rating		Scoping (Identified Impacts and Reasons)
			Stage Ⅰ/Ⅱ	Stage Ⅲ	
	33	Waste	B-		<Construction Stage> -Waste materials, residue soil/sand, etc. are generated from the construction site. General waste is generated from worker's lodgment. -Various wastes are generated during demolition of the existing bridge and rebuilding of flyovers (railway, road).
				D	No impact is expected.
	34	Noise and vibration	B-		<Construction Stage> -From transportation vehicles/vessels and construction heavy machines noise and generate. -Noise and vibration are generated during demolition of the existing bridge and rebuilding of flyovers (railway, road).
				B-	-There is a possibility of increased noise and vibration due to increase in traffic volume.
	35	Land subsidence	D	D	Since use of groundwater in a large quantity is not expected in the project, there is no possibility of land subsidence.
	36	Offensive odor	D		<Construction Stage> There is a small possibility of generation of offensive odor if there is no emission control of vehicles, vessels, and heavy machines.
				D	There is a small possibility of generation of offensive odor due to increase in number of passing vehicles.

<Stage>
Ⅰ : Planning Stage
Ⅱ : Construction Stage
Ⅲ : Operation Stage
<Rating>
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses).
D: No impact is expected.
Source: JICA Study Team

(2) TOR of surveys on environmental and social considerations

For the items selected from the results of scoping, details and methods were set as the TOR.

Table A1.53 shows the TOR of surveys on environmental and social considerations.

Table A1.53 TOR of Surveys on Environmental and Social Considerations

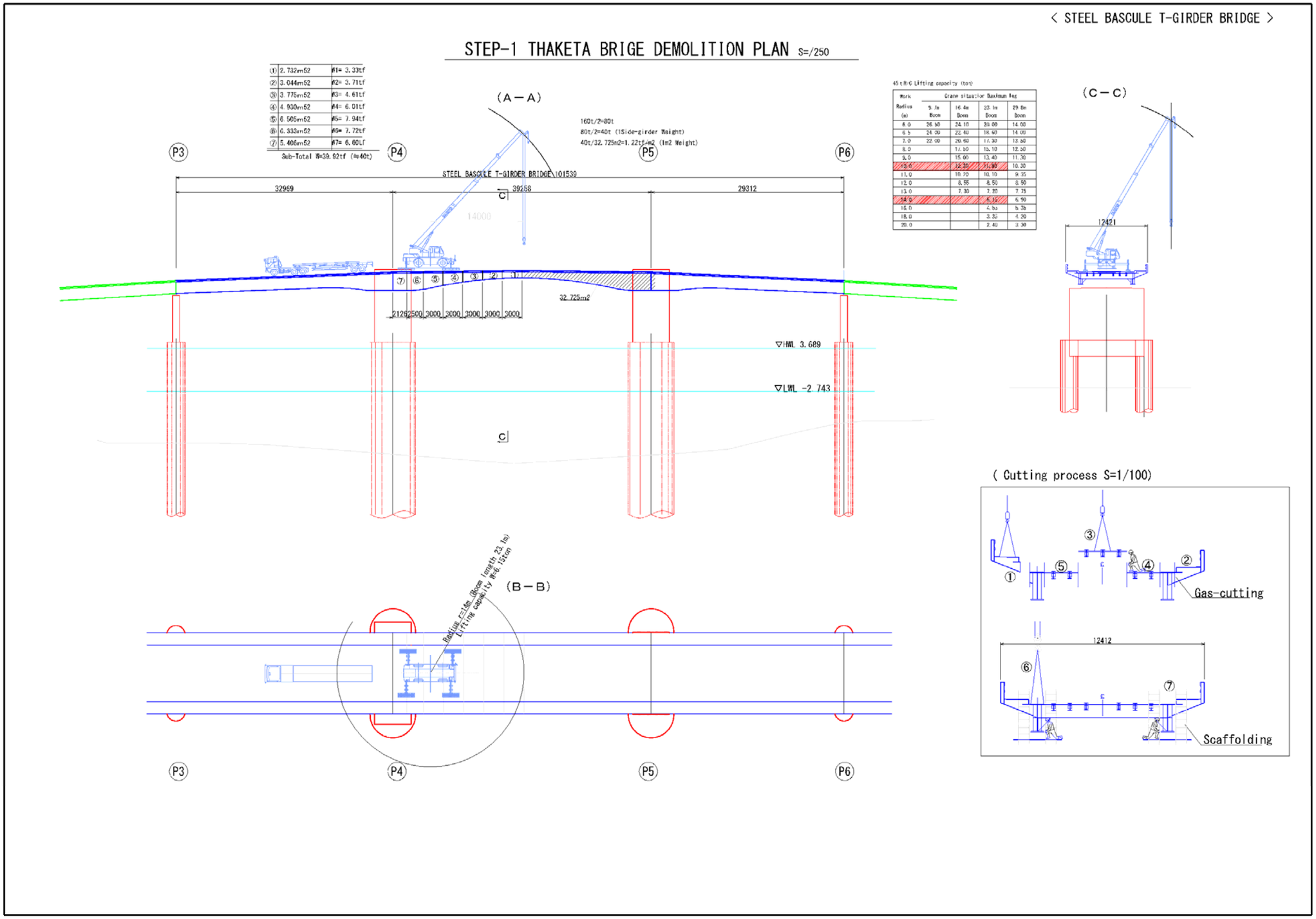
Environmental Item		Survey Item	Details and Methods of the Survey
Social Environment			
(1)	Land acquisition and involuntary resettlement	1) Promotion of structure relocation and resettlement. 2) Laws/regulations and case examples in Myanmar concerning land acquisition and resettlement.	1) To promote the procedure with agreement of project affected persons (PAPs) concerning structure relocation and resettlement. 2) -To utilize the study results for Japan's portion. -Collection and utilizaiton of case examples.
(2)	Existing social infrastructure and services	1) Situation of traffic restriction during construction. 2) Situation of infrastructure facilities and social service facilities around the project site. 3) Number of electric poles existing in the planned area.	1) To confirm traffic restriction during construction in the construction plan. 2) To utilize the data of the study for Japan's portion. 3) To utilize the data of actual preliminary survey.
(3)	Misdistribution of benefits and damages	Expected damages and benefits.	To confirm the expected benefits of the region in the project plan as well as the expected negative impacts to the region in environmental impact examination.
(4)	Water rights, fishing rights and rights of common	Use of land under the control of MPA during demolition of existing bridge.	To confirm the contents of the plan of demolition work.
(5)	Public health and sanitation	Current situation of the occurrence of respiratory disease.	To utilize the data of the study and monitoring for the Japan's portion.
(6)	Infectious diseases such as HIV/AIDS	Situation of tested and positive persons with infectious diseases such as HIV/AIDS around the project sites.	To utilize the data of the study and monitoring for Japan's portion.
(7)	Working conditions (including occupational health)	Laws and regulations in Myanmar concerning working conditions/work safety.	Survey of laws and regulations.
(8)	Accidents	Current state of traffic accidents in the areas around the project sites.	-To collect accident occurrence data by township area. -To utilize the data of the study and monitoring for Japan's portion.
Natural Environment			
(9)	Terrestrial fauna, flora, and ecosystems	1) Current state of terrestrial biota. 2) Existence of rare trees in the planned area. 3) Number of trees existing in the planned area.	To utilize the data of actual preliminary survey.
(10)	Aquatic fauna, flora and ecosystems	1) Current state of aquatic animal and benthos biota. 2) Impact on the aquatic animal and benthos during demolition of existing bridge.	1) To utilize the data of actual preliminary 2) To collect and utilize information of existing case examples.
(11)	Hydrological situation	Impact on hydrological situation by demolition work of existing bridge	-To confirm the contents of the plan of demolition work. -To collect and utilize information of existing case examples.

Environmental Item		Survey Item	Details and Methods of the Survey
(12)	Soil erosion	Conditions of topography, geology, and soil in the planned area.	To utilize the data of the survey of natural condition for Japan's portion.
Environmental Pollution			
(13)	Air pollution	1) Current level of ambient air quality. 2) Level of air pollution during demolition of existing bridge and flyovers (railway, road).	1) To utilize the data of the study and monitoring for Japan's portion. 2) To collect and utilize information of existing case examples.
(14)	Water pollution	1) Current level of water quality in the river. 2) Water pollutants discharged from fragment or scrap remained in the river during demolition of existing bridge. 3) Water pollutant discharged from mud that is rolled up from the river bottom during demolition of existing bridge.	1) To utilize the data of the study and monitoring for Japan's portion. 2), 3) To collect and utilize information of existing case examples.
(15)	Soil contamination	Possibility of discharging contaminants to the soil during widening of roads.	Confirmation of a possibility that whether chemical herbicide is used or not during construction work.
(16)	Bottom sediment	1) Current state of sediment quality of the river. 2) Bottom pollution by sedimentation and accumulation of pollutants generated during demolition of existing bridge.	1) To utilize the data of the study for Japan's portion. 2) To collect and utilize information of existing case examples.
(17)	Waste	1) Methods of treatment and disposal of construction waste and general waste during construction. 2) Contents of waste generated during demolition of existing bridge and rebuilding of flyovers (railway, road).	1) To confirm the methods of treatment/disposal of construction waste and general waste in the construction plan. 2) To collect and utilize information of existing case examples.
(18)	Noise and vibration	1) Current level of noise. 2) Level of noise and vibration during demolition of existing bridge and rebuilding of flyovers (railway, road).	1) To utilize the data of the study and monitoring for Japan's portion. 2) To collect and utilize information of existing case examples.

Source: JICA Study Team

Appendix 8 Reference Drawing for Removal of Existing Bridge

4. Reference drawing for bridge demolition



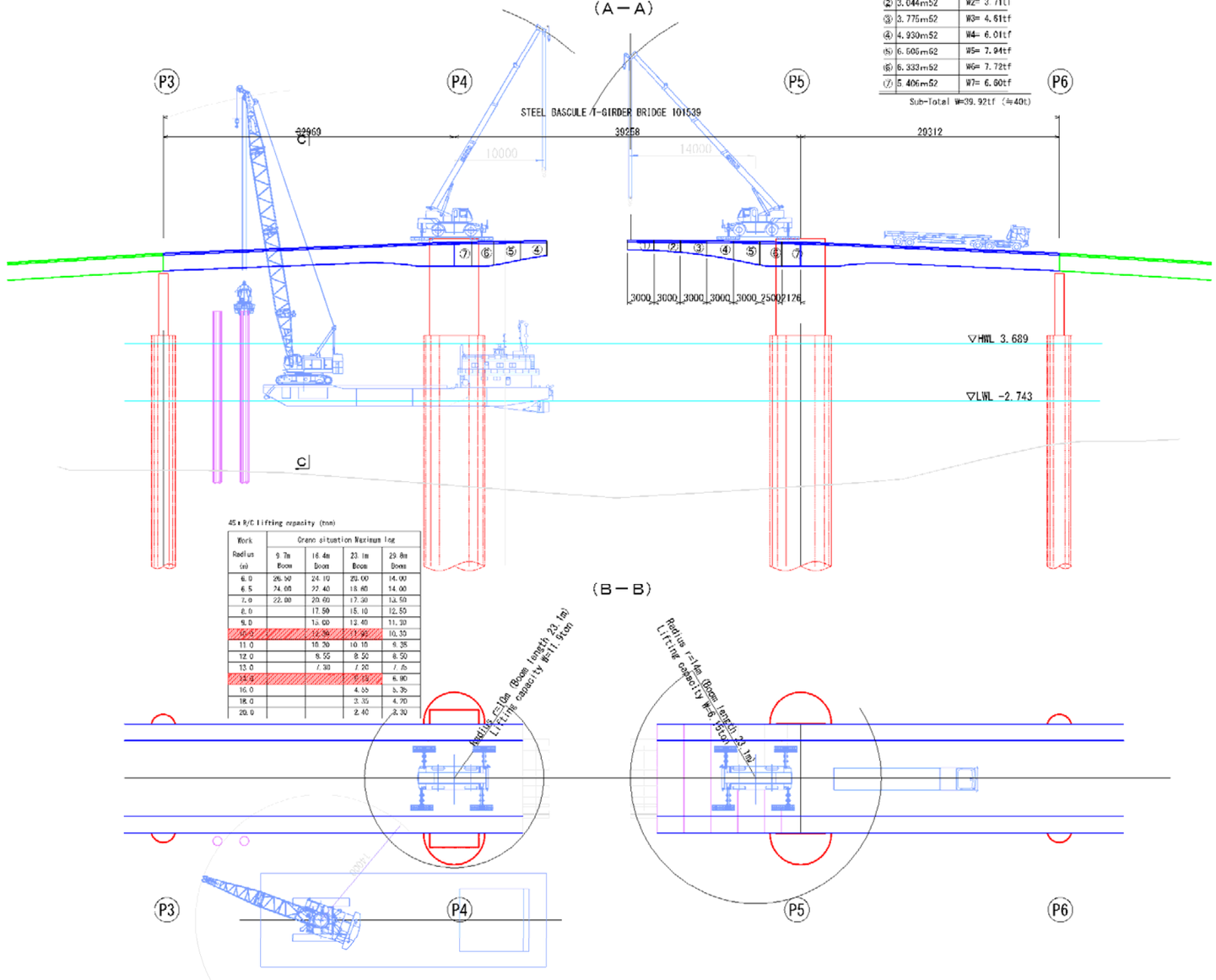
< STEEL BASCULE T-GIRDER BRIDGE >

STEP-2 THAKETA BRIGE DEMOLITION PLAN S=/250

①	2.732m52	W1= 3.33tf
②	3.044m52	W2= 3.71tf
③	3.775m52	W3= 4.61tf
④	4.930m52	W4= 6.01tf
⑤	6.606m62	W5= 7.94tf
⑥	6.333m52	W6= 7.72tf
⑦	5.406m52	W7= 6.60tf

Sub-Total W=39.92tf (≒40t)

(A－A)



45 x R/C Lifting capacity (ton)

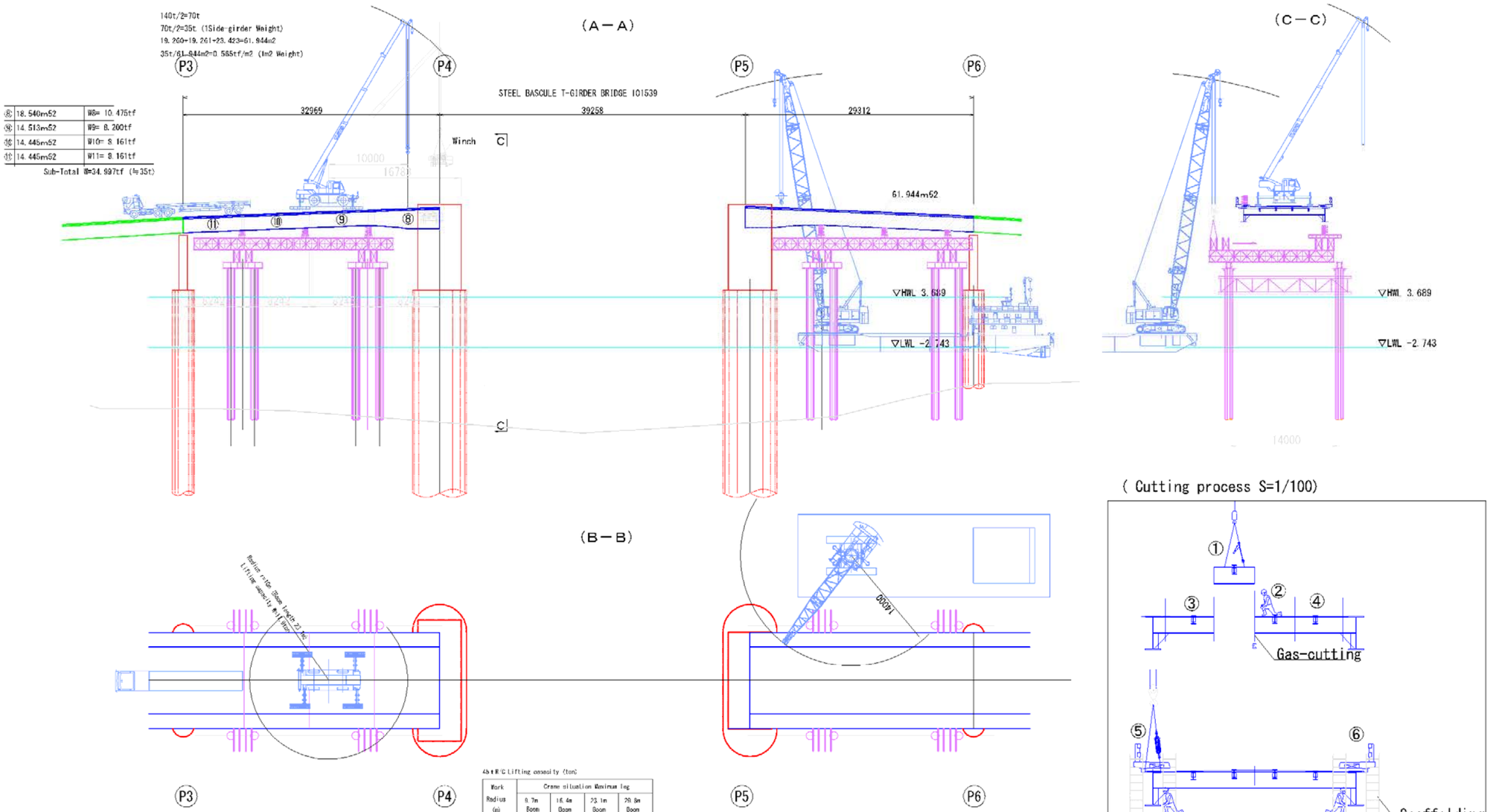
Work Radius (m)	Crane situation Maximum lag 9.7m Boom	16.4m Boom	23.1m Boom	29.8m Boom
6.0	26.50	24.10	20.00	14.00
6.5	24.00	22.40	18.60	14.00
7.0	22.00	20.60	17.30	13.50
8.0		17.50	15.10	12.55
9.0		15.00	13.40	11.30
10.0		13.30	11.90	10.35
11.0		10.70	10.15	9.35
12.0		8.55	8.50	8.50
13.0		7.30	7.20	7.15
14.0			6.15	6.90
16.0			4.35	5.35
18.0			3.35	4.20
20.0			2.40	3.30

(B－B)

(C－C)

< STEEL BASCULE T-GIRDER BRIDGE >

STEP-3 THAKETA BRIGE DEMOLITION PLAN S=/250



45t RIG Lifting capacity (ton)

Work Radius (m)	Crane situation Minimum leg			
	9.7m Boom	16.4m Boom	23.1m Boom	29.8m Boom
6.0	26.50	24.10	20.00	14.00
6.5	24.00	22.40	18.60	14.00
7.0	22.00	20.60	17.30	13.50
8.0		17.50	15.10	12.50
9.0		15.00	13.40	11.30
10.0		12.30	11.90	10.30
11.0		10.20	10.10	9.35
12.0		8.55	8.50	8.50
13.0		7.30	7.20	7.75
14.0			6.15	6.90
16.0			4.55	5.35
18.0			3.35	4.20
20.0			2.40	3.30

(Cutting process S=1/100)

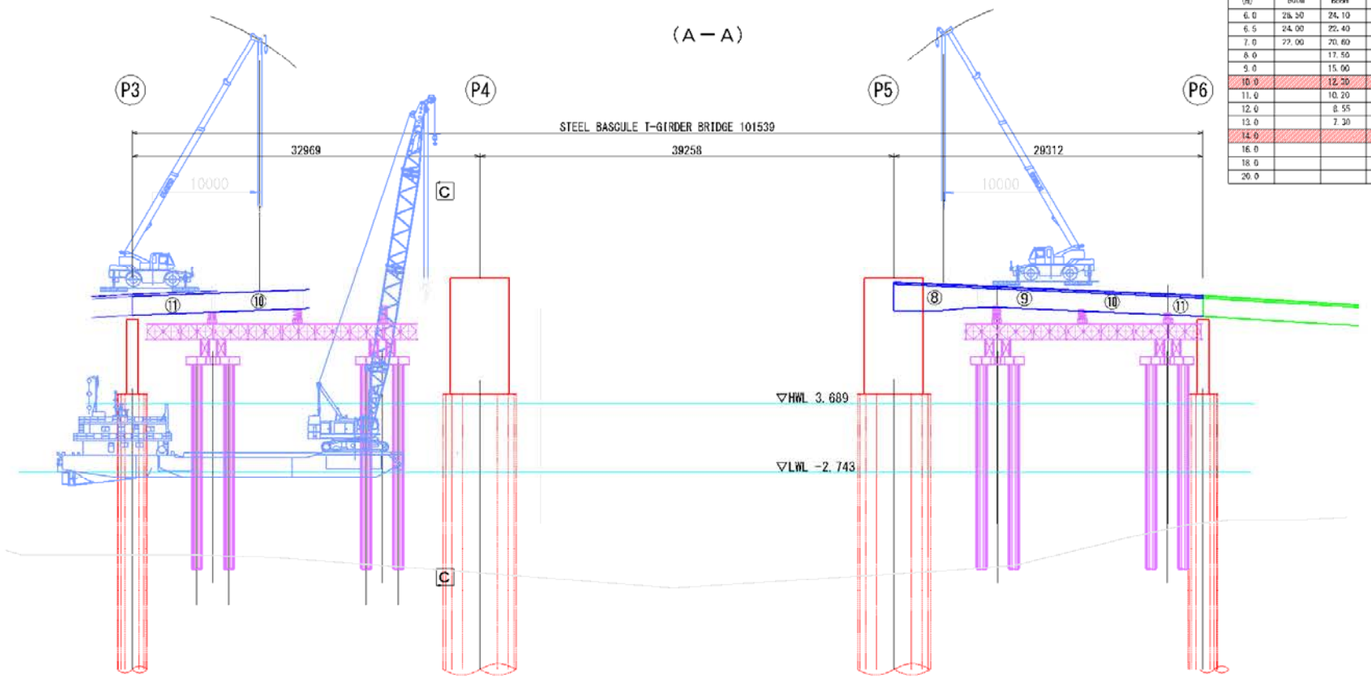
< STEEL BASCULE T-GIRDER BRIDGE >

STEP-4 THAKETA BRIGE DEMOLITION PLAN S=/250

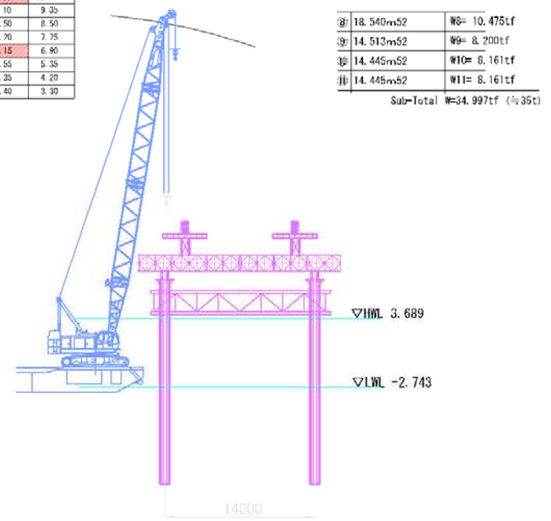
45 t R/C Lifting capacity (ton)

Work Radius (m)	Crane situation Maximum leg 9.7m Boom	16.4m Boom	23.1m Boom	29.0m Boom
6.0	28.50	24.10	20.00	14.00
6.5	24.00	22.40	18.60	14.00
7.0	22.00	20.60	17.30	13.50
8.0		17.50	15.10	12.50
9.0		15.00	13.40	11.50
10.0		12.20	11.90	10.50
11.0		10.20	10.10	9.35
12.0		8.55	8.50	8.50
13.0		7.30	7.20	7.15
14.0			6.15	6.00
16.0			4.55	5.35
18.0			3.35	4.20
20.0			2.40	3.30

(A－A)



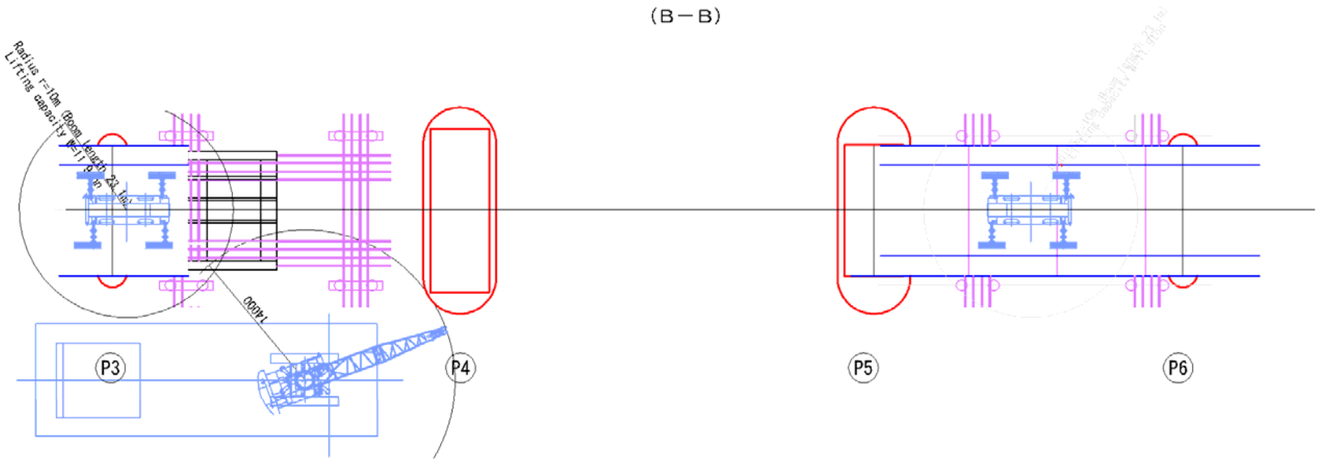
(C－C)



⑧	18.540m52	W8= 10.475tf
⑨	14.513m52	W9= 8.200tf
⑩	14.445m52	W10= 8.161tf
⑪	14.445m52	W11= 8.161tf

Sub-Total W=34.997tf (≒35t)

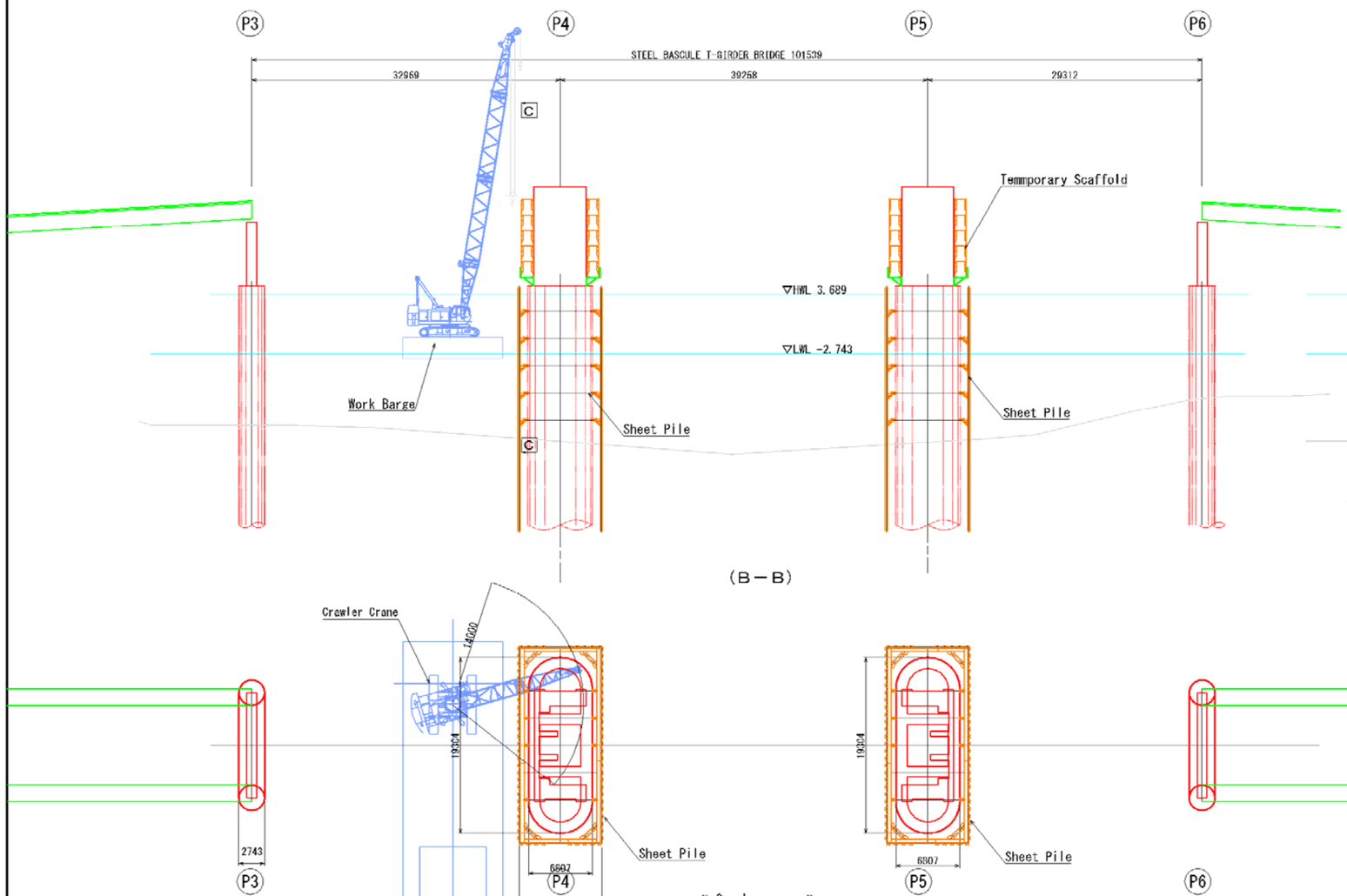
(B－B)



< Pier P4 & P5 >

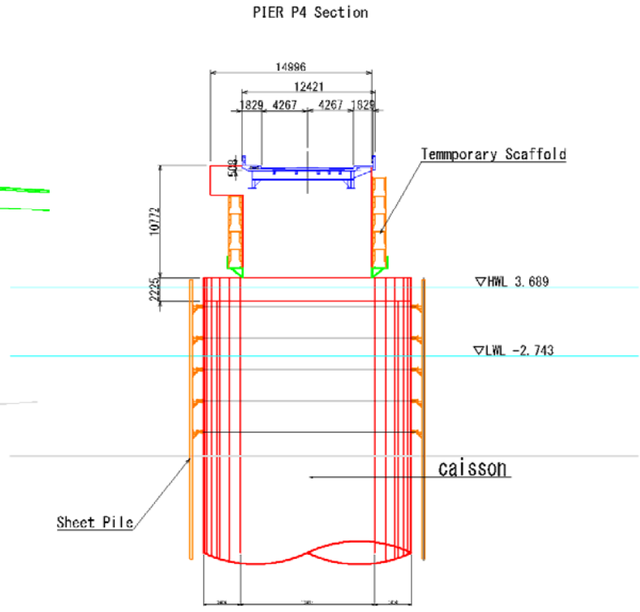
STEP-5 THAKETA BRIGE DEMOLITION PLAN S=/250

(A－A)



(B－B)

PIER P4 Section



≪ Crawler crane ≫

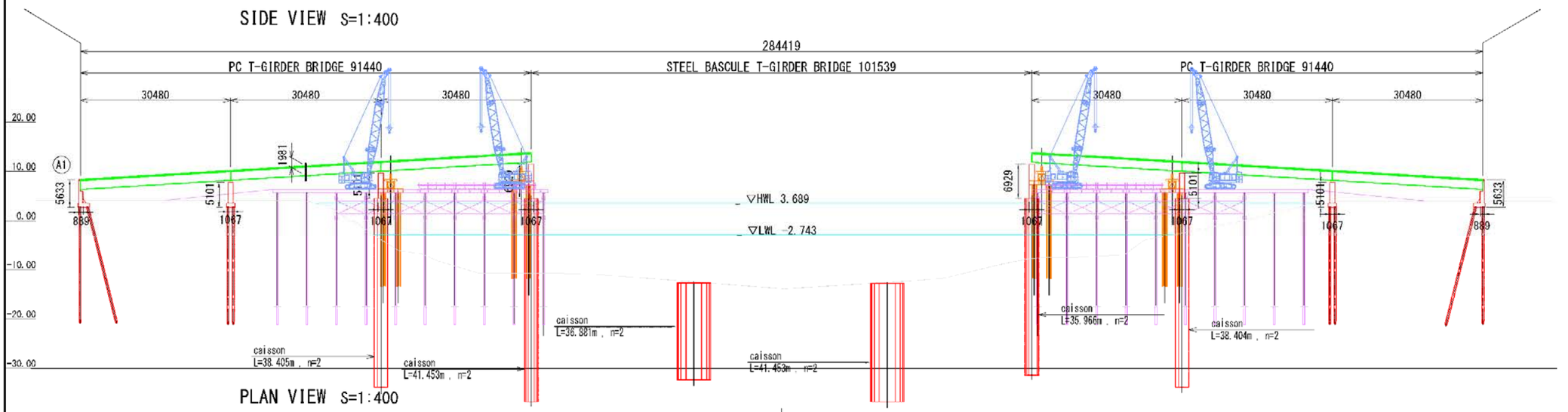
KOBELCO-7080(Max.cap 80tf C/C)

Working Radius (m)	Working Load (tf)		
	18.3m	21.3m	24.4m
5.0m	60.0 t	59.4 t	50.0 t
6.0m	48.5 t	48.5 t	48.5 t
7.0m	38.8 t	38.7 t	38.6 t
8.0m	32.0 t	31.9 t	31.8 t
9.0m	27.2 t	27.1 t	27.0 t
10.0m	23.6 t	23.4 t	23.3 t
12.0m	18.3 t	18.3 t	18.2 t
14.0m	15.1 t	15.0 t	14.8 t

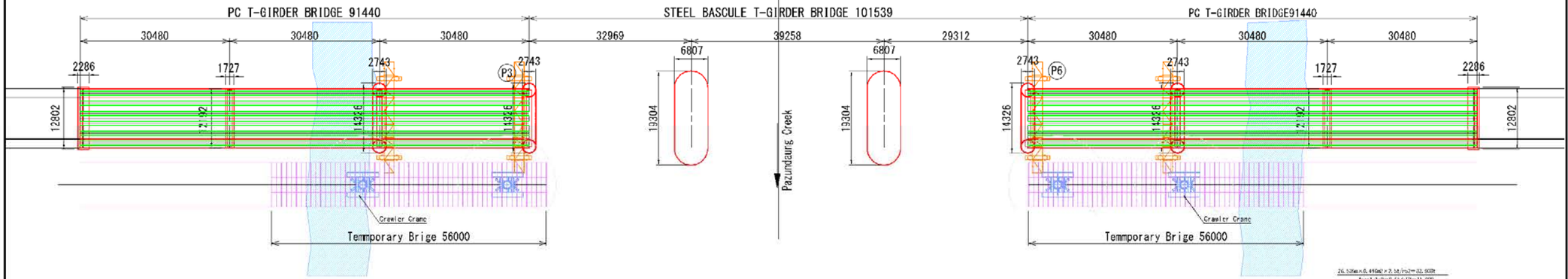
< PC T-GIRDER BRIDGE >

STEP-6 THAKETA BRIGE DEMOLITION PLAN S=/400

SIDE VIEW S=1:400



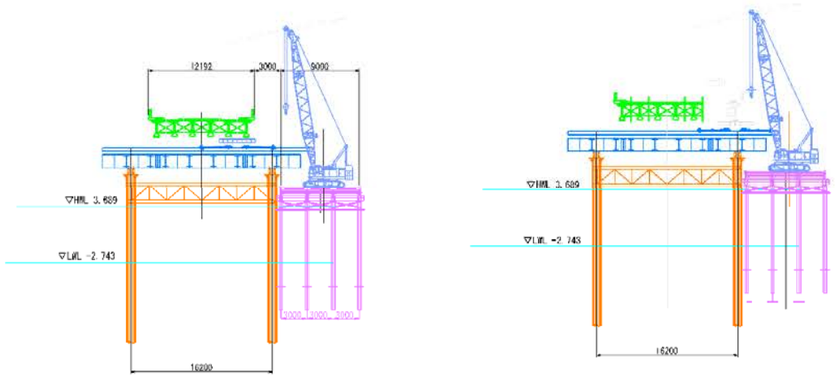
PLAN VIEW S=1:400



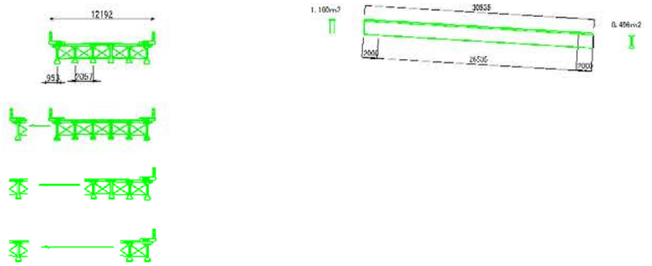
< Crawler crane >
KOBELCO-7080(Max cap 80tf C/C)

Working Radius	Boom length		
	19.3m	21.3m	24.4m
5.0m	80.0 t	80.0 t	80.0 t
6.0m	46.5 t	46.5 t	46.5 t
7.0m	38.8 t	38.7 t	38.6 t
8.0m	32.0 t	31.9 t	31.8 t
9.0m	27.2 t	27.1 t	27.0 t
10.0m	23.6 t	23.7 t	23.5 t
12.0m	18.3 t	18.2 t	18.1 t
14.0m	15.1 t	15.0 t	14.8 t

(Section S=1/300)



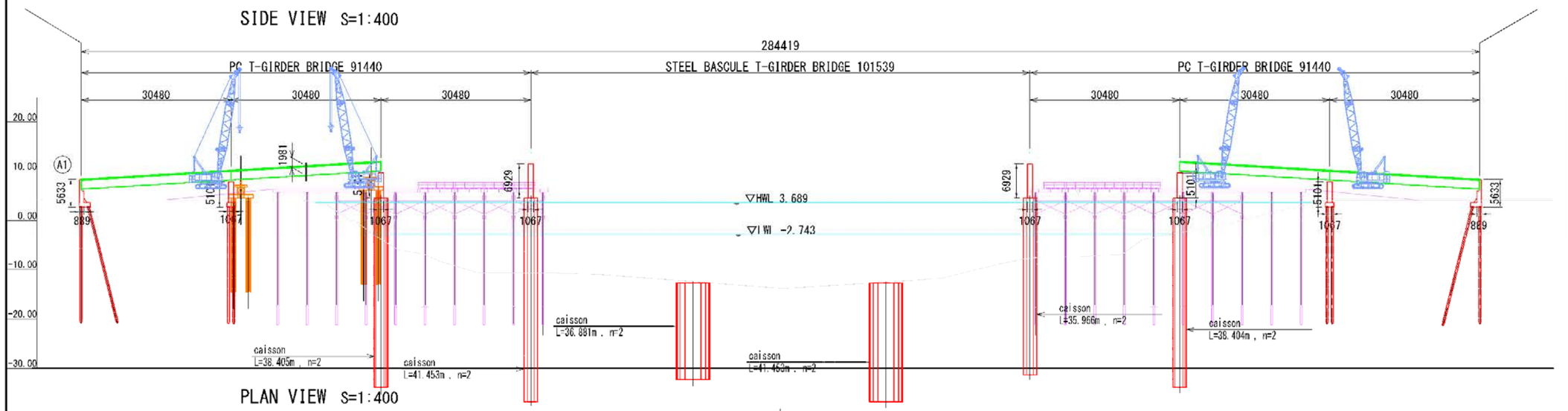
(Demolition process S=1/300)



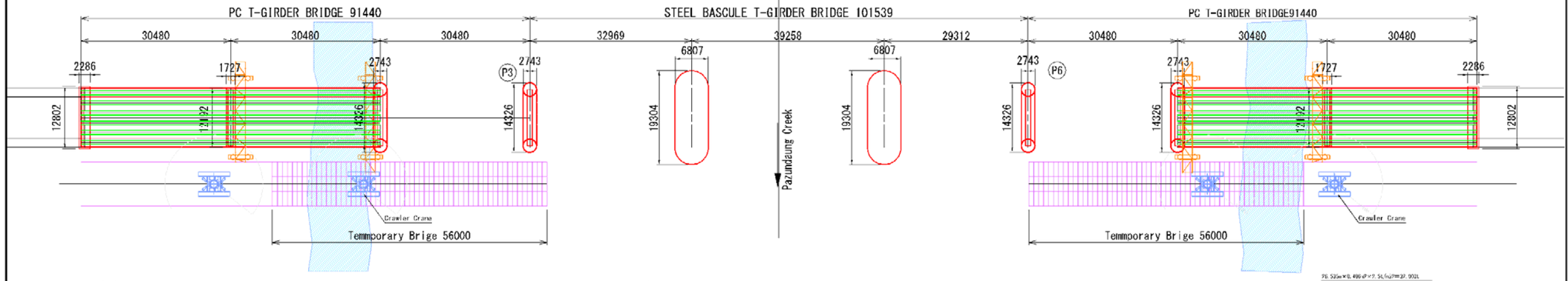
< PC T-GIRDER BRIDGE >

STEP-7 THAKETA BRIGE DEMOLITION PLAN S=/400

SIDE VIEW S=1:400



PLAN VIEW S=1:400

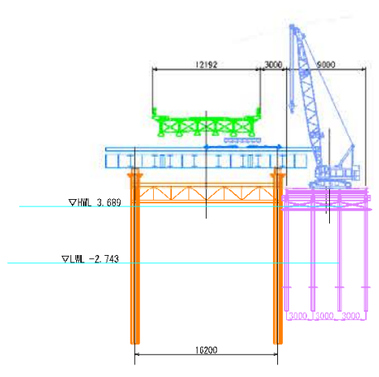


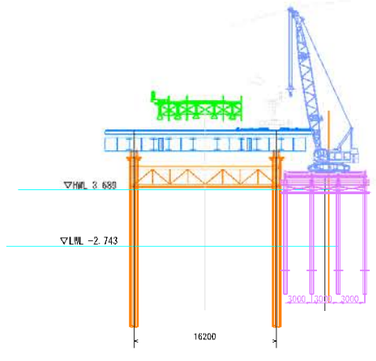
< Crawler crane >

MODEL:CC-7000 (Max. cap 60tf C/C)

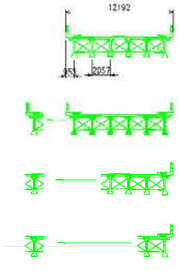
Working radius (m)	Height of boom (m)		
	18.3m	21.0m	24.4m
5.0m	60.0 t	58.4 t	50.0 t
6.0m	46.3 t	46.5 t	46.5 t
7.0m	36.8 t	36.7 t	36.6 t
8.0m	32.0 t	31.9 t	31.8 t
9.0m	27.2 t	27.1 t	27.0 t
10.0m	23.7 t	23.6 t	23.5 t
12.0m	18.2 t	18.2 t	18.2 t
14.0m	15.1 t	15.0 t	14.9 t

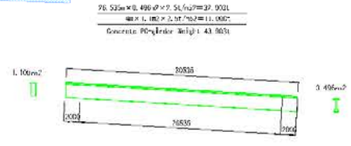
(Section S=1/300)





(Demolition process S=1/300)

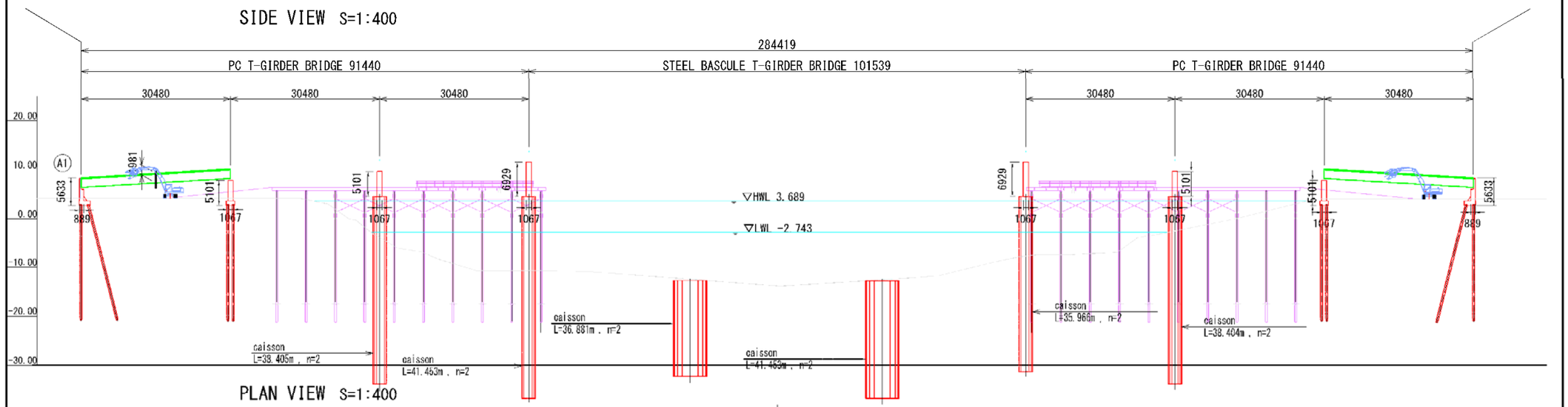




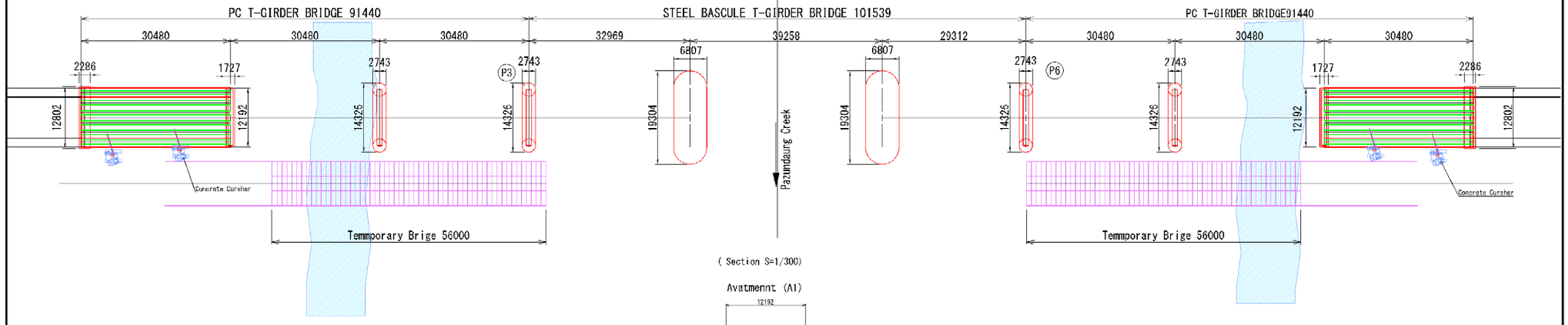
< PC T-GIRDER BRIDGE >

STEP-8 THAKETA BRIGE DEMOLITION PLAN S=/400

SIDE VIEW S=1:400

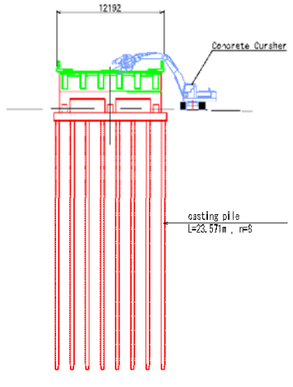


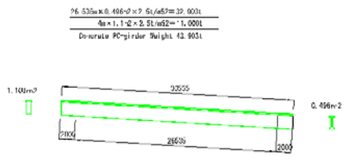
PLAN VIEW S=1:400



(Section S=1/300)

Avatmennt (A1)

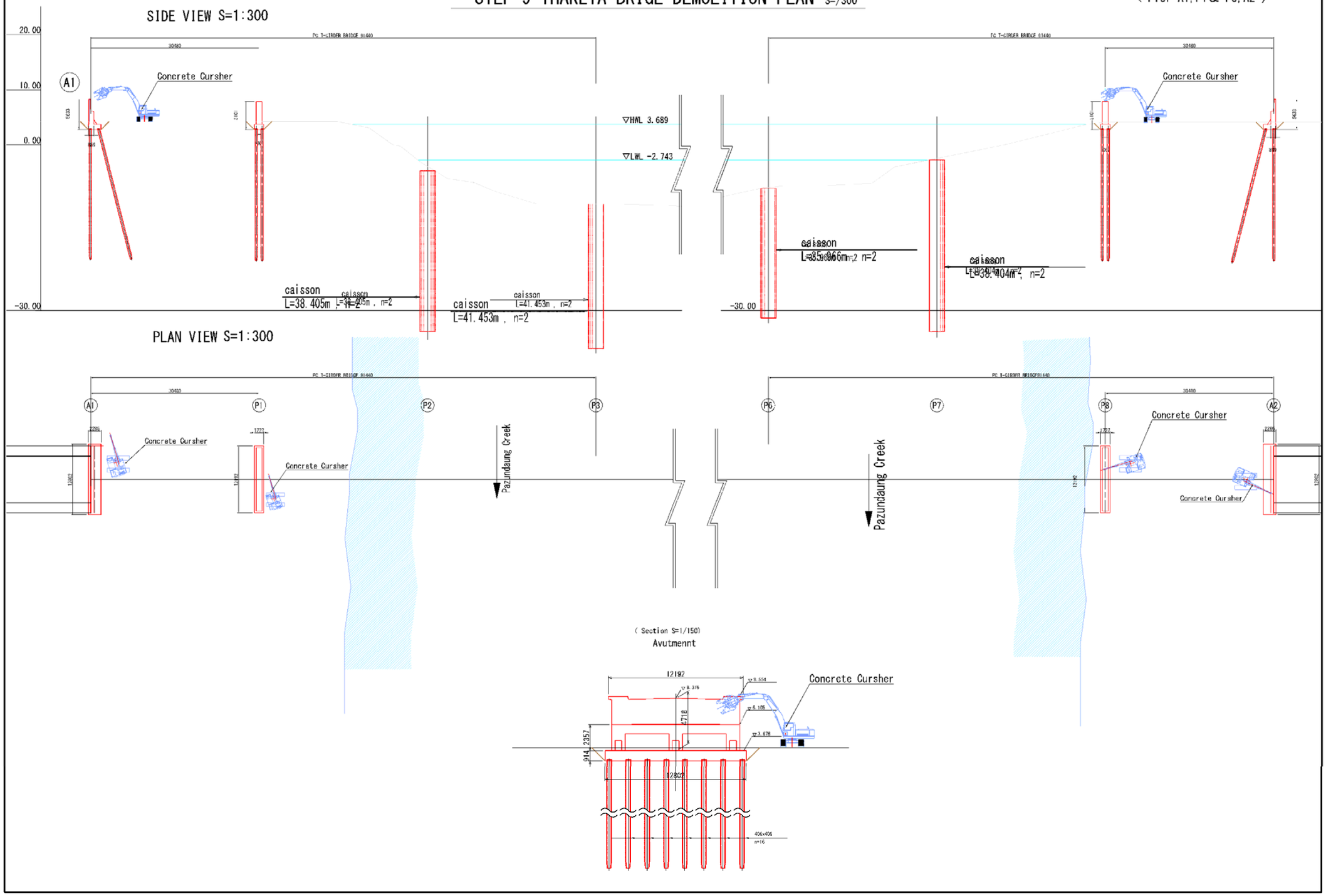




STEP-9 THAKETA BRIGE DEMOLITION PLAN S=/300

< Pier A1, P1 & P8, A2 >

SIDE VIEW S=1:300



PLAN VIEW S=1:300

(Section S=1/150)
Avutmennt