Attachment

Attachment

Ethiopian Roads Authority
The Federal Democratic
Republic of Ethiopia

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR REPLACEMENT OF GOGECHA BRIDGE & MODJO BRIDGE ON A1 TRUNK ROAD
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

January 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

CENTRAL CONSULTANT INC.

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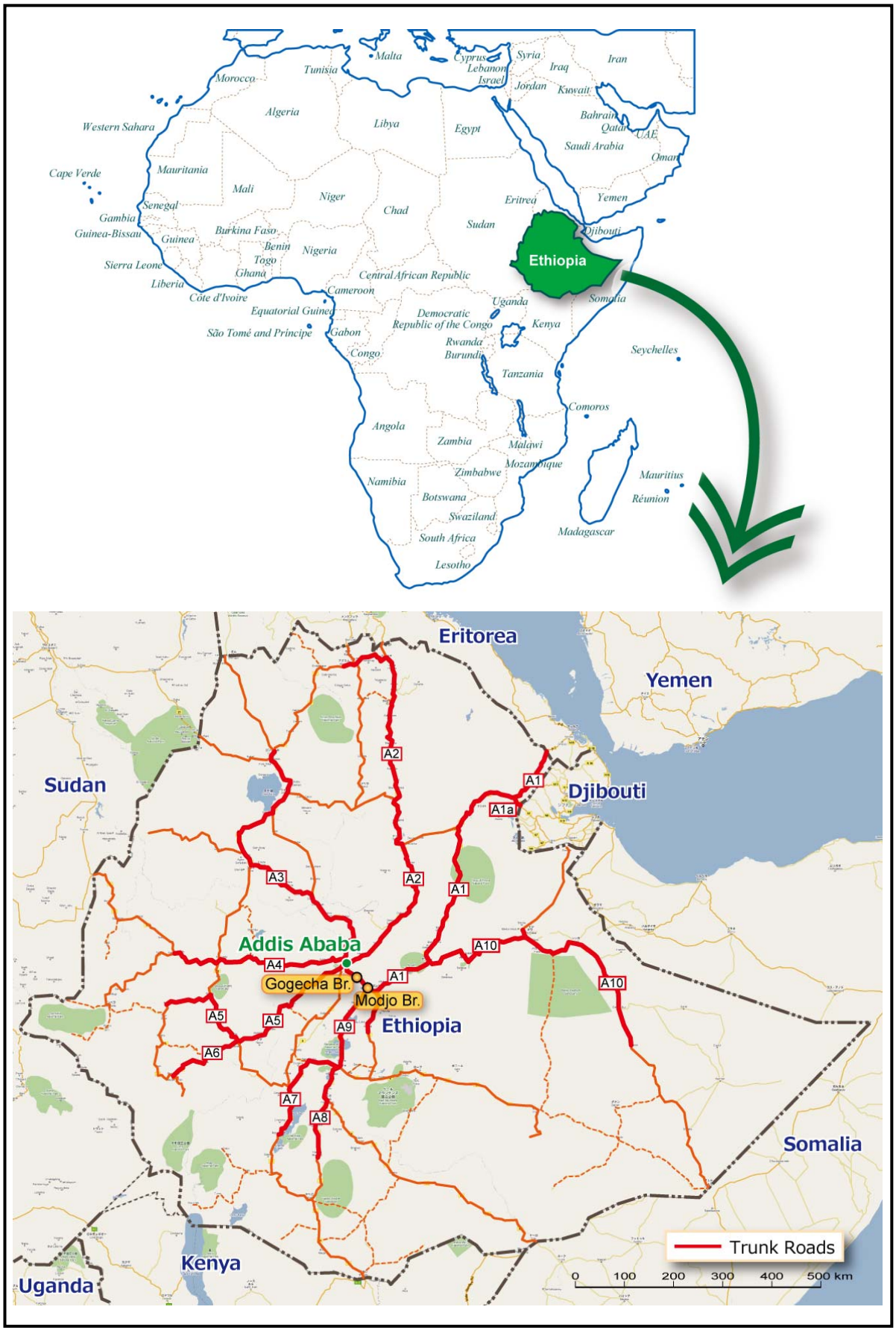
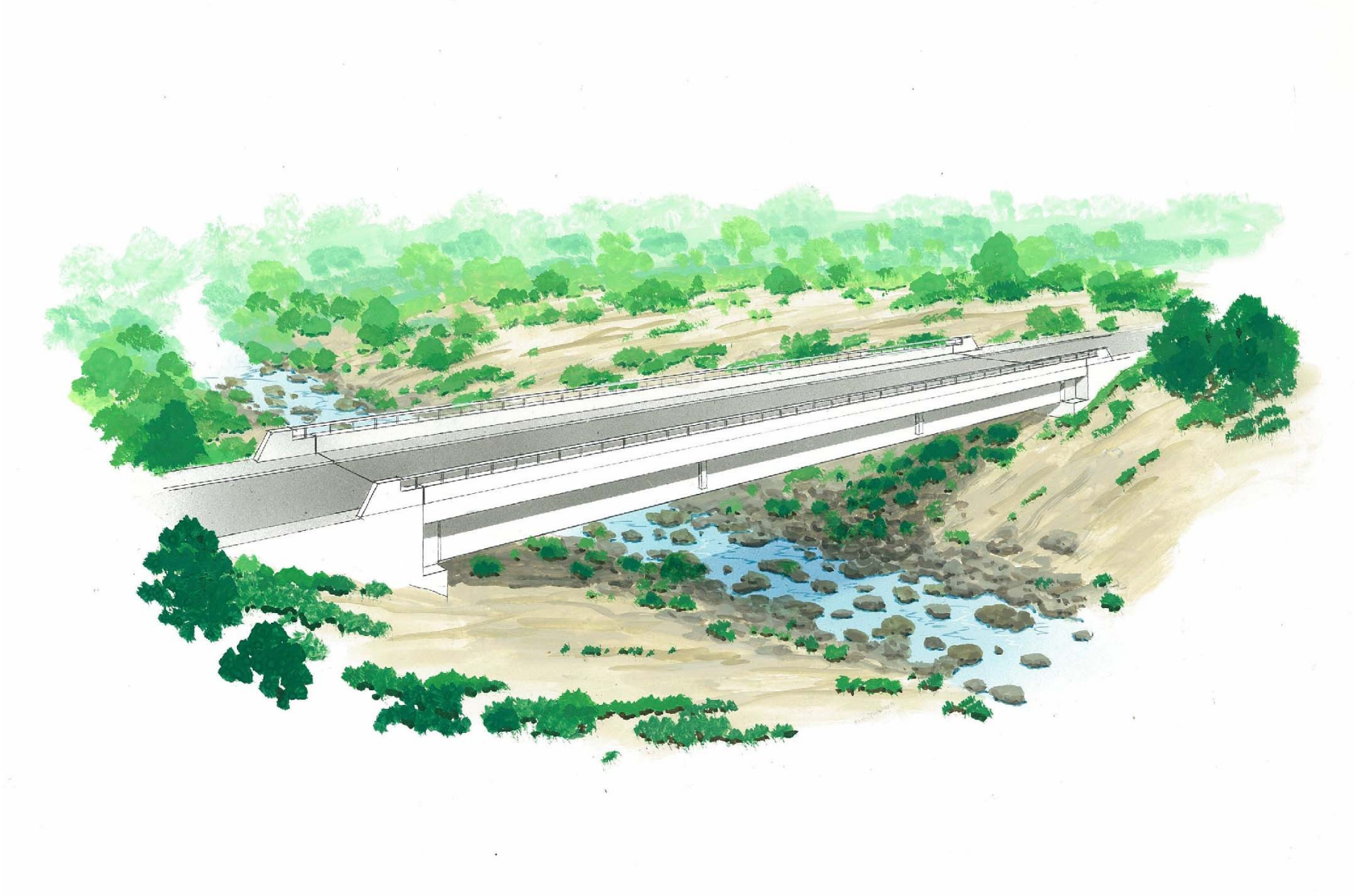
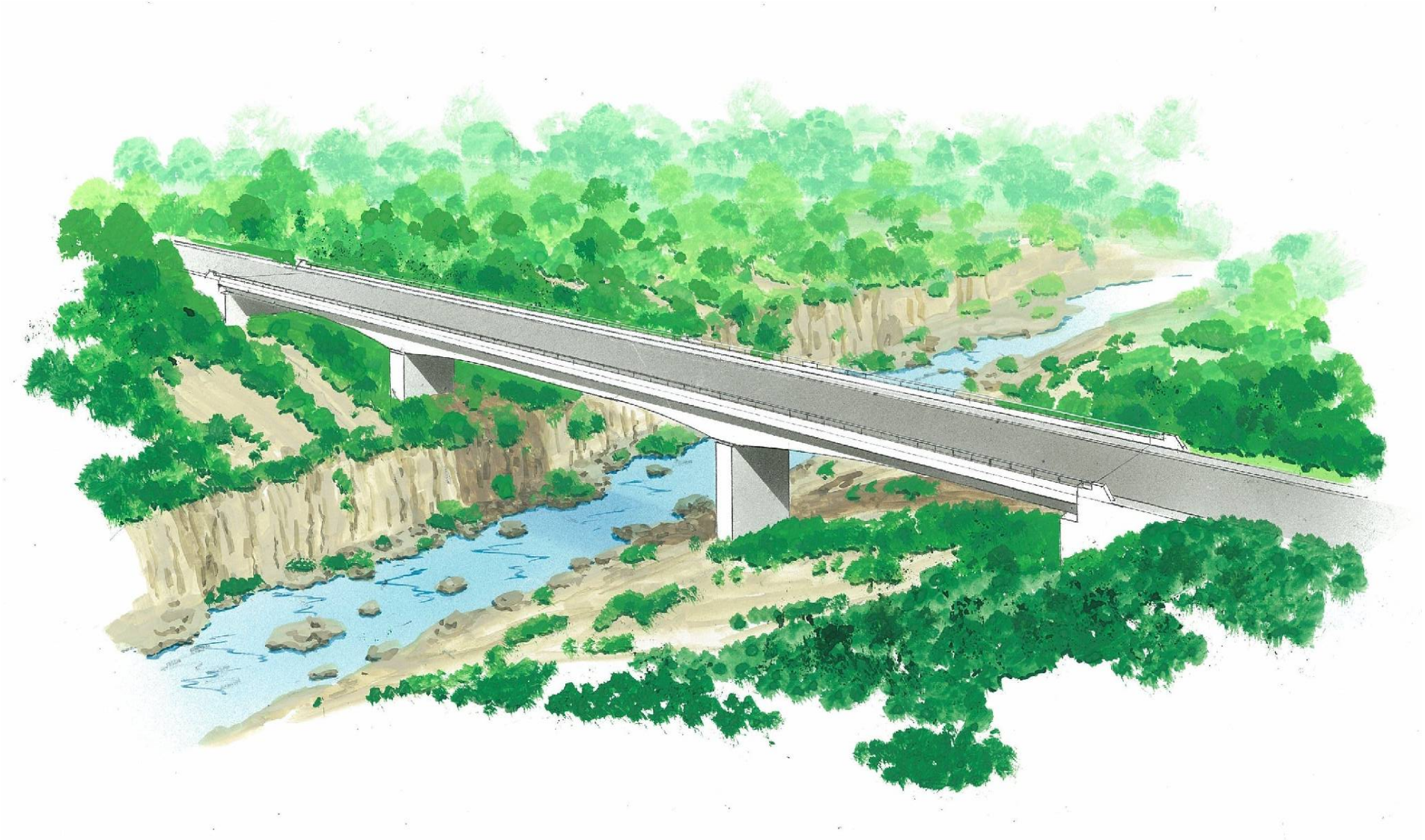


Location Map



Perspective view of Gogecha Bridge



Perspective view of Modjo Bridge

Chapter 1 Basic Concept of the Project

The original request from the Ethiopian Government consisted of reconstruction of three bridges, Gogecha, Modjo and Awash Bridges. However, the Governments of Japan and Ethiopia agreed to exclude Gogecha and Modjo Bridges from the request because of the budgetary constraint on the Japanese side and project implementation by the Ethiopian side.

Therefore, the main text of this summary describes only matters concerning Awash Bridge and matters concerning Gogecha and Modjo Bridges are described in the attachment.

1-1 Overall Goal and Project Goal

1-1-1 Ethiopian Road Development Plan

The Ethiopian government, in order to improve the road development status of the country, established RSDP (1997-2007) (Road Sector Development Program) and started to implement RSDPI, the Phase 1 of this program, in July 1997 with the completion targeted for June 2002. RSDP is a comprehensive road development plan including policies and improvement of implementing organizations and is used by all the other donors and aid organizations to examine the methods for assistance because it is the only overall goal for all the road development plans in Ethiopia. Therefore, the road development plans in Ethiopia are to be implemented in accordance with RSDP. The target roads under the jurisdiction of the federal government in this Program are Trunk Roads and Link Roads/Main Access Roads, and the plan implementing organization is the Ethiopian Roads Authority (ERA).

Note that bridges are covered in the Bridge Rehabilitation Program (BRP), a sub-program of RSDP. The bridges included in the request in this project are also the target bridges in BRP.

1-1-2 Overall Goal and Project Goal

The overall goal of this project and the project goal are as follows:

・Overall goal

A1 Trunk Road, the most important trunk road in Ethiopia and an international trunk road, shall be improved to promote economic development of the country.

・Project goal

Ethiopia is an inland country surrounded by Djibouti, Eritrea, Sudan, Kenya, and Somalia, with 95% of its traffic and transportation available via roads. Therefore, international trunk roads are the most important means of transportation for physical distribution and human exchange with the surrounding countries. Among them, A1 Trunk Road ranks as the most important route with a total distance of 853 km, connecting the capital Addis Ababa and the Port of Djibouti in the neighbor country to handle 90% of import and export of Ethiopia.

The prompt reconstruction of Gogecha and Modjo Bridges on A1 Trunk Road are requested because they have been significantly deteriorated and damaged.

The goal of this project is to rebuild Gogecha and Modjo Bridges in order to eliminate the traffic bottlenecks and also invigorate international physical distribution, improve traffic access for local residents, promote economic growth and poverty reduction in the surrounding areas.

1-2 Project Overview

To attain the goals described above, this grant-aid project shall perform the outline design and the cost estimation by rebuilding Gogecha and Modjo Bridges. The direct outputs from the implementation of this project are avoidance of possible falling of Gogecha and Modjo Bridges and decrease of traffic accident victims by installation of sidewalks on these bridges, consequently promoting international physical distribution, invigorating local economy, improving the standard of living, and reducing poverty, etc.

1-3 Environmental and Social Consideration

1-3-1 Environmental Impact Assessment (EIA) of Road Projects

(1) Procedures of EIA examination by ERA and environmental permission

Figure 1-3-1 shows the procedure of survey and examination and permission regarding environmental impacts.

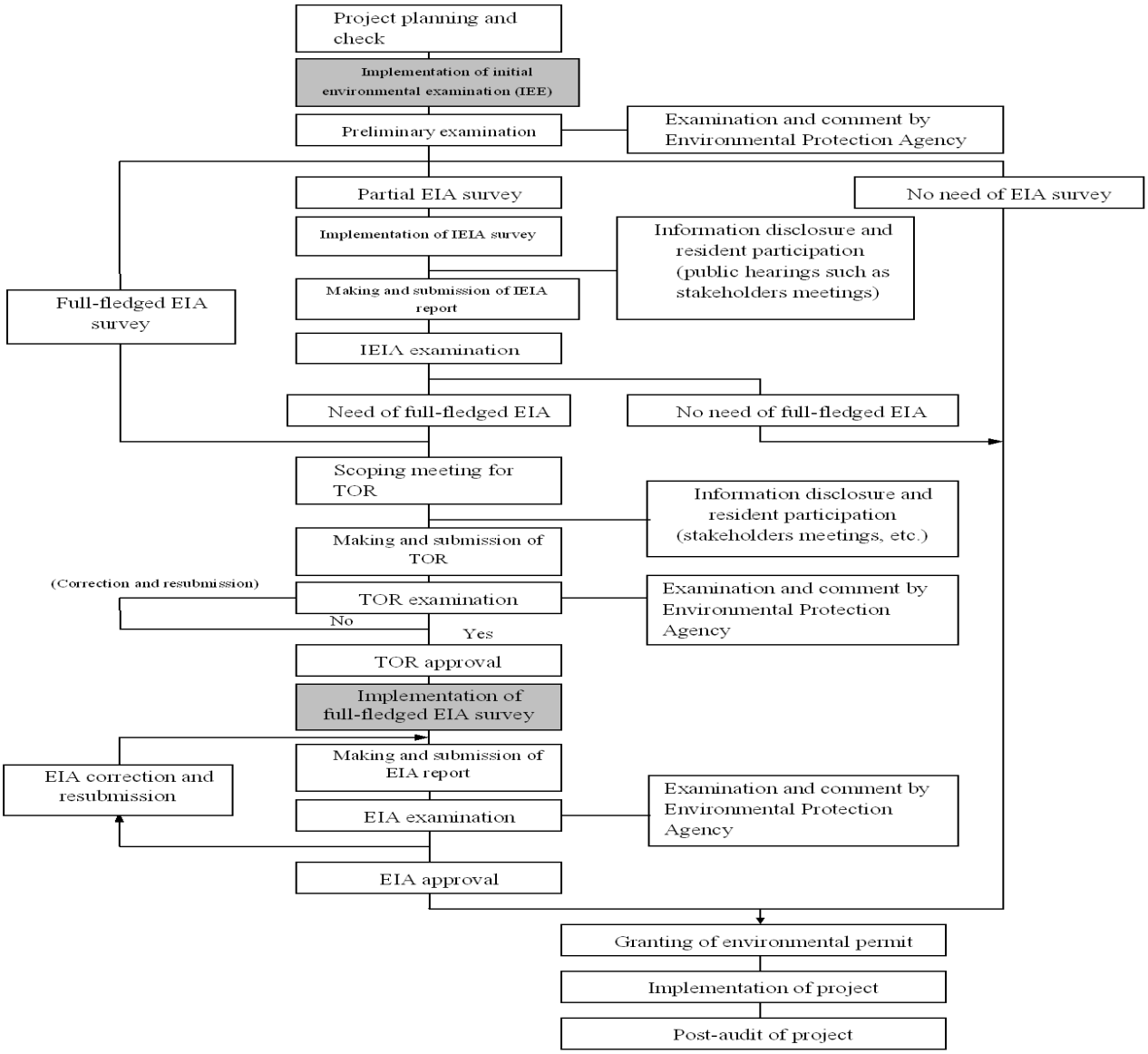


Figure 1-3-1 Procedure of EIA permission by ERA

1-3-2 Legislation and System of Land Expropriation

(1) System of land expropriation and compensation

Figure 1-3-2 shows the procedure of land expropriation, compensation, etc. in road projects by ERA.

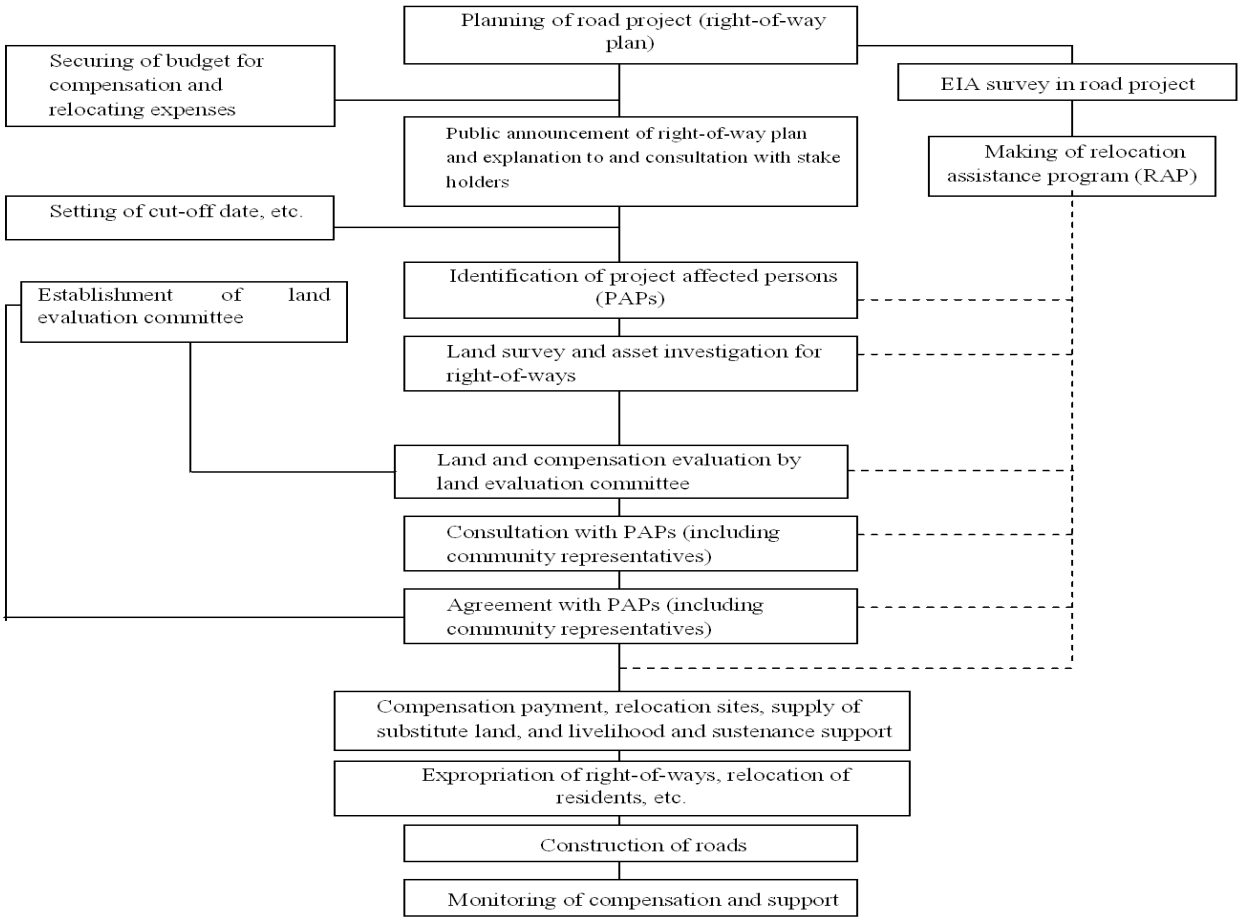


Figure 1-3-2 Procedure of land expropriation, compensation, etc. in road projects

As shown in Figure 1-3-2, the cut-off date is the date at which the consultation with stakeholders regarding the required land was held, providing explanation to and consultation with them.

(2) Setting of right-of-way (ROW)

The right-of-way (ROW) used as the basis of environmental and social impact evaluation in this project is set as the range of 50 m, 25 m each on both sides from the centerline of the road when conducting environmental and social impact survey. The design manual issued by ERA in 2002 classifies roads into DS1 to DS10 categories in accordance with the traffic volumes and assigns DS1 to DS5 to Trunk Roads, stipulating various specifications of them and defining the ROW for them as 50 m regardless of the topographic features. For other road categories, the ROW decreases as 40 m, 30, and 20 m in accordance with a decreasing traffic volume, with the Feeder Roads DS10 being the smallest. The three bridges in this project rank as Trunk Roads from the beginning, which have been examined with a ROW of 50 m as for DS1 or DS2. On the other hand, the design manual specifies that, when any of the ROWs is to be changed, an approval must be obtained after clarifying the reasons, in the same way as for other specifications. One of the reasons for this requirement is

environmental consideration for alleviating the relocation of residents. For example, there is a reported case of one local road (IDA assistance) with a ROW of 30 m, which was reduced to 20 m in the section where it passes through an urban built-up area.

The design manual adds a margin of 3 m to the width to allow for the top of cutting slope or toe of banking slope when cutting or banking is needed depending on the topographical feature. In the case of a temporary detour for Modjo Bridge, which is to be rebuilt, a margin of 3 m will be secured for construction in part of the cutting, but the specified ROW width is not required.

1-3-3 Environmental and Social Consideration Survey

(1) Consistency between JICA guidelines and Ethiopian rules

The 2004 JICA Environmental and Social Consideration Guidelines are applied to this project. However, the environmental rules of Ethiopia have been established, in principle, in accordance with the environmental standards of the World Bank and, in particular, the resettlement policy OP4.14 is applied. There is no great discrepancy because the 2004 JICA Guidelines also specify that the international standards of advanced countries should be applied (Note: The new JICA Guidelines issued in April 2010 specifies OP4.12). However, attention must be paid to the point that the compensation to be made in acquisition of land for a public purpose is not monetary compensation for the land itself but only supply of substitute land, showing a great gap with the international standards.

(2) Comparison of alternative routes and zero option

Table 1-3-1 shows the result of comparison of principal environmental impacts of alternatives and selected routes for the two Bridges.

Table 1-3-1 Alternatives and principal environmental impacts

	Alternative	Principal environmental impact	Selected route
Gogecha Bridge	1. Upstream shift	Land acquisition and building removal	2-1. Current bridge position and upstream detour was selected.
	2. Current bridge position	None	
	2-1 Temporary bridge/upstream detour	Temporary land tenancy and fence removal	
	2-2 Temporary bridge/downstream detour	None	
	3. Downstream shift	Land acquisition and building removal	
Modjo Bridge	1. Upstream shift	Land acquisition and building and fence removal	2-1. Current bridge position and upstream detour was selected.
	2. Current bridge position	None	
	2-1 Temporary bridge/upstream detour	Temporary land tenancy and building and fence removal	
	2-2 Temporary bridge/downstream detour	Land acquisition and building removal	
	2-3 Ex-A1 detour	Traffic pollution in Modjo	
	3. Downstream shift	Land acquisition and building removal	

Zero option

A1 Trunk Road to be improved in this project is regarded as an important road as a principal trade route connecting the capital Addis Ababa and the Port of Djibouti in the neighbor country to handle 90% of import and export of Ethiopia. Ethiopia requested for reconstruction of Gogecha and Modjo

Bridges, the two bridges located on this route, which have been considerably damaged and not reconstructed for a long time. As a result of field reconnaissance implemented in accordance with the request, both Gogecha and Modjo Bridges were found to be in an extremely dangerous state, requiring prompt reconstruction rather than repair and reinforcement. In particular, Gogecha Bridge with the largest traffic volume among the three bridges has been deteriorated so much that bouncing of floor plates is visible to eyes when a heavy vehicle passes and may fall at any moment. If Modjo Bridge, crossing a deep valley, becomes impassable, it is extremely difficult to construct a temporary bridge in a short term due to topographic difficulties. The detours of two bridges other than A1 Road, with poor road conditions and narrow lane widths, are not sufficient for the current traffic volume and passing of large vehicles. In sum, the reconstruction of the two target bridges is highly and urgently needed. Without reconstruction, the bridges would be further deteriorated, possibly resulting in blocking of roads and serious traffic jams due to falling of bridges, accidents, etc. This would paralyze the major transport artery of Ethiopia, having a significant impact on the social economy of the country. Although this project concerns reconstruction of the two bridges, Ethiopia, an inland country, must secure the passage of A1 Trunk Road, a major artery for physical distribution with other countries, by all means.

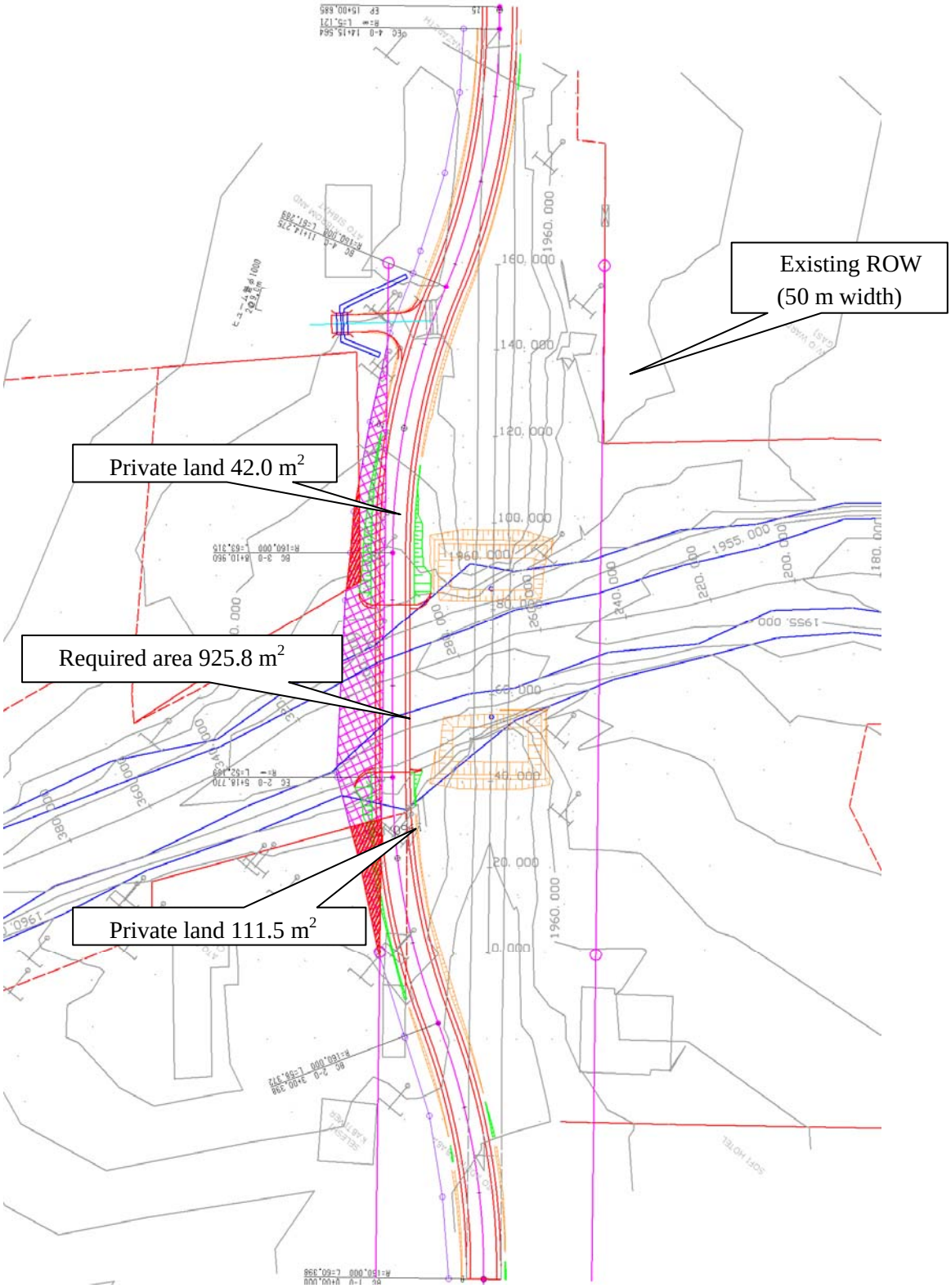
(3) Scoping result and categorization

In accordance with the JICA guidelines, we found that this project is not expected to have a great impact on the social and natural environment items, in particular the resettlement and the valuable ecological system in national parks, in any of the areas surrounding the bridge. Therefore, the project was concluded as Category B that required Initial Environmental Examination (IEE). On the other hand, a joint environmental survey conducted in collaboration with ERA-EMSB in the first field reconnaissance concluded that this project is not a Schedule I project that requires EIA survey but a Schedule II project that requires the initial environmental impact assessment (IEIA). An IEIA report must be accompanied with an Abbreviated Relocation Assistance Program (Abbreviated RAP) in accordance with the WB standard. Therefore, we concluded that an IEIA report based on the Ethiopian standard sufficiently corresponds to an IEE report based on the JICA standard, and confirmed again with the Ethiopian side in a statement of mutual agreement that an IEIA report would be submitted by them.

(4) Land to be acquired and proportion of private land to the total area

Figure 1-3-3 shows the map of land that needs to be acquired for the site, which has been made after the final route, is determined. Using this site map, a joint field reconnaissance survey was conducted in collaboration with ERA-EMSB to check the usage conditions of the required land. Then, area calculation was conducted using the survey drawing to obtain approximate areas of the site as shown in Table 1-3-2.

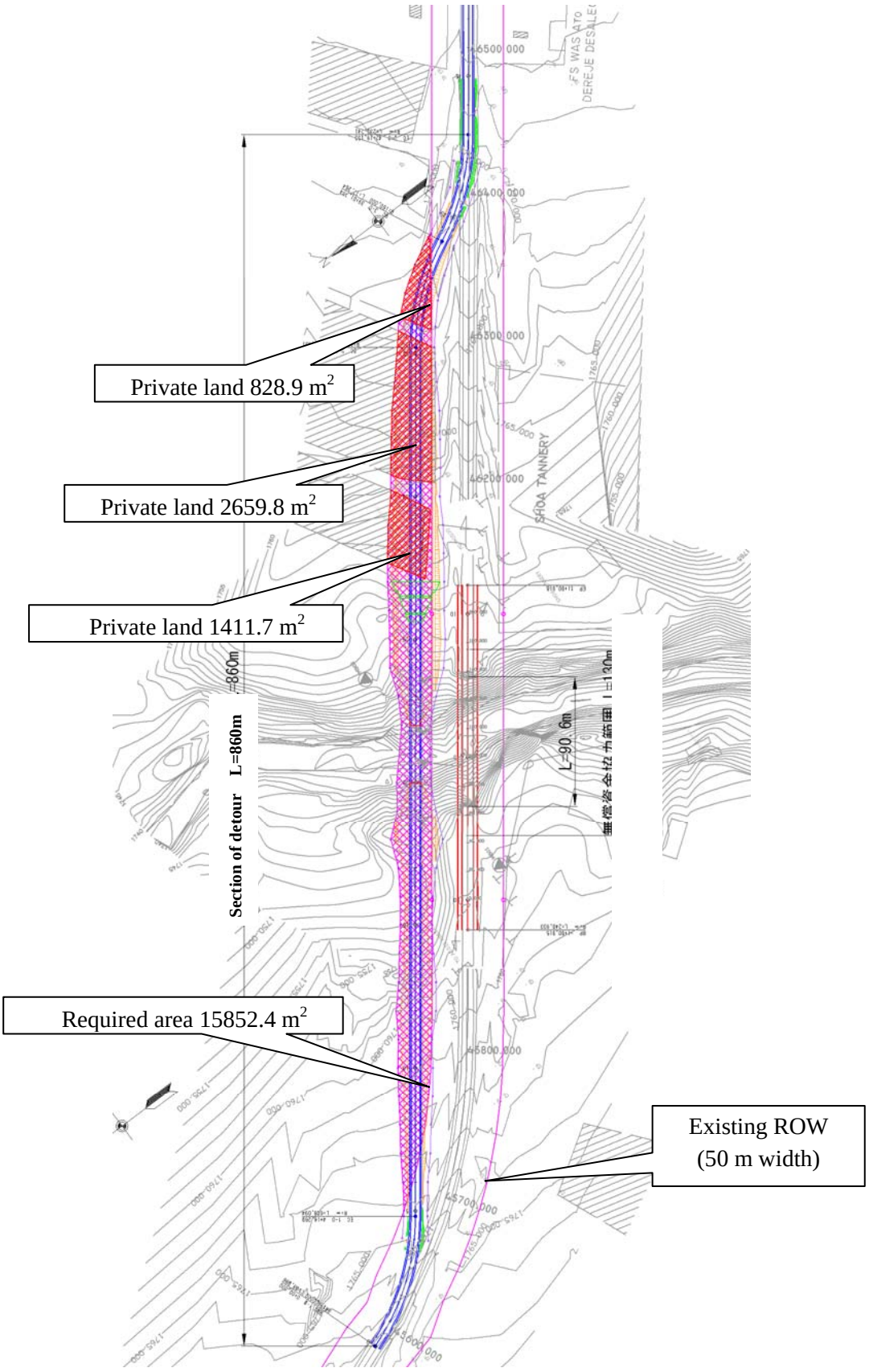
Note that the site maps also show the percentages of private land to the total area, which are 6.6% (temporary tenancy only) for Gogecha Bridge, 30.9% (temporary tenancy only) for Modjo Bridge .



Percentage of private land to the leased land area

=（42.0+111.5）/925.8＝16.6%

Figure 1-3-3　Map of required land for Gogecha Bridge detour



Percentage of private land to the leased land area

=（828.9+2659.8+1411.7）/15852.4＝30.9%

Figure 1-3-4　Map of required land for Modjo Bridge detour

Classification		Gogecha Bridge	Modjo Bridge	Total
Permanently acquired land	National land	0	0	43,000
	Private land	0	0	0
Total		0	0	43,000
Temporarily leased land	National land	800	11,000	11,800
	Private land	200 (Company 2)	1,400 (Company 2)	1,600
		X	800 (Farmland 1)	800
		X	2,700 (Pasturage 1)	2,700
Total		1,000	15,900	16,900
Sum total		1,000	15,900	59,900

Table 1-3-2 Area of land needing to be acquired (m^2)

Source: ERA's Abbreviated Relocation Assistance Program (Abbreviated RAP since October 2010)

(5) Consultation with stakeholders and setting of cut-off date

Figure 1-3-2 shows the procedure of land expropriation, compensation, etc. in road projects, which require public announcement of a site plan and explanation to and consultation with stakeholders before the setting of a cut-off date. In accordance with this procedure, the explanation of the project was provided in the first stakeholder consultation held in May, and the explanation of required land was scheduled for the second stakeholder consultation. Thus, we provided explanation on Gogecha Bridge on July 28, Modjo Bridge on July 28 at Dukem and Modjo Town Halls respectively, with the assistance of the Local Administration Department in charge of this project, which ended successfully.
As a traditional practice, the cut-off date after which entry to the required land is prohibited is the date of signatures affixed by the administrative division in charge and the representative of consultation participants in the minutes of each stakeholder consultation. However, it was reported that the cut-off date for this project is the date of each consultation. Furthermore, ERA notified us that public announcement of the cut-off date would also be made on newspapers.
The organizations and associations regarded to have direct and indirect interests and therefore requested to participate in stakeholder consultations include district organization offices, affected municipal offices, Wereda (county)-level offices, district water resource offices, district telegram and telephone offices, district E.P.C. offices, Wereda-level water resource offices, district organizations in charge of statistics, and Wereda-level organizations in charge of agriculture, Kebele (district) offices in rural villages and cities, and elders in communities.

(6) Results of survey on social environment including resettlement

On July 13 and 14 after the completion of maps of required land for the planned two bridge sites, a joint field reconnaissance with the environmental protection division of ERA was conducted on the natural environment and social impacts. Furthermore, interviews were held in the field for directly and indirectly affected residents.

Table 1-3-3 shows the number of households (organization) influencing land acquisition in this project.

Table 1-3-3 Number of households (organization) influencing land acquisition

Site	① Land acquisition only	Land acquisition and building relocation	① Land tenancy only	④ Land tenancy and building relocation	⑤ Electric wire, telephone cable, and water pipe relocation	PAPs Total
Gogecha Bridge	0	1 (Barrack as storeroom)		1 (Fence)	2* (Electric wires and telephone cables)	4
Modjo Bridge	0	0	2 (Farmland and pasturage)	2 (Office + fence or fence only)	3* (Electric wires, telephone cables, and water pipes)	7
PAPs Total	0	1	2	3	5*	11

The Gogecha Bridge (2) case shown in the table above, the land acquisition and building relocation (barrack as storeroom), includes a small space considered to be unlawfully occupied in the ROW according to the supervisor who said that he had heard from the owner that this barrack was a case of unlawful occupation. Furthermore, some temporarily leased land space is also included. According to the Ethiopian guidelines, a compensation is paid even to squatters for their barracks. Since the public facilities in case (5) are those of the power and telephone companies and district offices, the 13 PAPs in total include only six PAPs that are private households (including organizations), and there is no relocation of ordinary houses. Around the two bridges, there are no kiosks or mobile stores, unlike in other bridge projects in which many are encountered.

(7) Mitigation measures against environmental loads

Table 1-3-4 shows the mitigation measures against expected environmental loads. The environmental load items in this project does not include those under A rating that are expected to have serous impacts but only those under B rating that are expected to have minor impacts. Among all the expected environmental loads, those in social environment items including resettlement shall be handled on the initiative of ERA by implementing mitigation and countermeasures against them.

On the other hand, the environmental loads caused by the construction work on the natural environment including the social environment and pollutions shall be defined in the construction specification prepared for tendering, and a building contractor shall be required to submit before the start of construction an environmental management plan (EMP), which shall be examined and approved with the consent of ERA. Then, a construction supervisor and the contractor's employee in charge of EMP shall be selected to perform monitoring of EMP compliance status during construction. Furthermore, the contractor shall be required to submit a monthly report on the compliance status, and quick action shall be taken on the site as required.

All of these progress statuses and results shall be reported to JICA in monthly reports. For particularly important items, reports on strictly lawful compensation progress statuses and results are required for land use and resettlement. As early as possible before the start of construction, the baseline data for the natural environment and pollutions shall be acquired and confirmed.

(8) Checklist required for future environmental management

In Preparatory Survey Part 1 (2009), the sector-by-sector "environmental checklist" to be used for check survey for environmental and social consideration in the project were applied to roads and bridges, and the check items were checked at the time of Preparatory Survey Part 1 (2009). In the implementation stage of this survey Part 2, a final decision was made on the candidate routes, and the decision was confirmed, as summarized in Table 1-3-5.

Table 1-3-4 Environmental Monitoring Plan

ENVIRONMENTAL MONITORING PLAN AND FORM

Project: The project for Replacement of the Bridges on A1 Truck Road in the Federal Democratic Republic of Ethiopia.

The C/P is to implement environmental monitoring referring to this monitoring plan and form all through the period from Pre-Construction phase, Construction phase and Liability phase after construction, and report to JICA periodically.

Details of the Monitoring shall be referred to JICA Report and followed to the approved Environmental Management Plan (EMP) submitted by the contractor required in the Specification of the Tender Documents for the Construction

1. Environmental Monitoring Plan

Phase	Item	Location	Frequency
Pre -Construction	Acquisition of Baseline Data on items specified in the following form.	River: 50m up and down streams from the bridge Land: Area along the JICA project approach road sections and area affected by land acquisition and / or on the ROW lines on both sides	Once
During Construction	Monitoring on the items specified in the following form.	Same as the above	Quarterly
Liability after Construction Completed (1 year)	Same as the above	Same as the above	2 Times: 3 months & 10 months after construction

2. Environmental Monitoring Form

Ⅰ. Pre-Construction Phase

Ⅰ-1. Social Environment

Item		Monitoring Results and Date Monitored
1	Involuntary Resettlement / Land Acquisition	Progress and Numbers, interview comments, and explain complain(s) and solution made if happened
4	Social institutions such as social infrastructure and local decision-making institutions	
6	The poor, indigenous and ethic people	
7	Misdistribution of benefit and damage	
11	Public Health and Sanitation	
12	Hazards (Risk) infectious diseases such as HIV/AIDS	
13	Disaster (Landslide)	
14	Accidents	
15	Security (Land mines)	

Ⅰ-2. Natural Environment

Item		Monitoring Results and Date Monitored
16	Topography and Geographical features	
17	Soil Erosion	
19	Hydrological Situation	
21	Flora, Fauna and Biodiversity	
22	National Parks and Reserves	
23	Landscape	

Ⅰ-3. Pollution

Item		Monitoring Results and Date Monitored
26	Air Pollution	Dust, Exhaust,
27	Water Pollution	SS, Oil, Grease,
28	Soil Contamination	
29	Bottom sediment	
30	Waste	
31	Noise and Vibration	
33	Offensive Odor	

Ⅱ. Construction Phase

Ⅱ-1. Social Environment

Item		Monitoring Results and Date Monitored
1	Involuntary Resettlement / Land Acquisition	Progress and Numbers, interview comments, and explain complain(s) and solution made if happened
4	Social institutions such as social infrastructure and local decision-making institutions	
6	The poor, indigenous and ethic people	
7	Misdistribution of benefit and damage	
11	Public Health and Sanitation	
12	Hazards (Risk) infectious diseases such as HIV/AIDS	
13	Disaster (Landslide)	
14	Accidents	
15	Security (Land mines)	

Ⅱ-2. Natural Environment

Item		Monitoring Results and Date Monitored
16	Topography and Geographical features	
17	Soil Erosion	
19	Hydrological Situation	
21	Flora, Fauna and Biodiversity	No excessive tree cutting inside and outside of ROW
22	National Parks and Reserves	
23	Landscape	

Ⅱ-3. Pollution

Item		Monitoring Results and Date Monitored
26	Air Pollution	Dust, Exhaust,
27	Water Pollution	SS, Oil, Grease,
28	Soil Contamination	
29	Bottom sediment	
30	Waste	
31	Noise and Vibration	
33	Offensive Odor	

Ⅲ. Liability after Construction

Ⅲ-1. Social Environment

Item		Monitoring Results and Date Monitored
1	Involuntary Resettlement / Land Acquisition	Confirmation of compensation completed as planed in RAP and as agreed by PAPs
4	Social institutions such as social infrastructure and local decision-making institutions	
6	The poor, indigenous and ethic people	
7	Misdistribution of benefit and damage	
11	Public Health and Sanitation	
12	Hazards (Risk) infectious diseases such as HIV/AIDS	
13	Disaster (Landslide)	
14	Accidents	
15	Security (Land mines)	

Ⅲ-2. Natural Environment

Item		Monitoring Results and Date Monitored
16	Topography and Geographical features	
17	Soil Erosion	
19	Hydrological Situation	
21	Flora, Fauna and Biodiversity	No excessive tree cutting inside and outside of ROW
22	National Parks and Reserves	
23	Landscape	

Ⅲ-3. Pollution

Item		Monitoring Results and Date Monitored
26	Air Pollution	Dust, Exhaust,
27	Water Pollution	SS, Oil, Grease,
28	Soil Contamination	
29	Bottom sediment	
30	Waste	
31	Noise and Vibration	
33	Offensive Odor	

NOTE: Confirmation of restoration of works made by sites works such as temporary access roads, construction yards, camp sites and others.

Table 1-3-5 Environmental Check List

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			Twi bridges (Gogecha and Modjo Bridges)
1 Permits and Explanation	(1) EIA and Environmental Permits	(1) Have EIA reports been officially completed? (2) Have EIA reports been approved by authorities of the host country's government? (3) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (4) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(1)/(3) The category is Schedule II, and IEIA reports will be made by the end of October. (2) Due to a change in the rules, ERA itself can approve the reports, which will be approved in the middle of November. (4) Not needed.
	(2) Explanation to the Public	(1) Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? (2) Are proper responses made to comments from the public and regulatory authorities?	(1) The stakeholder consultation was conduced twice in May and July. The cut-off date was set as July 28 for Gogecha and Modjo Bridges. (2) Addressed.
2 Mitigation Measures	(1) Air Quality	(1) Is there a possibility that air pollutants emitted from various sources, such as vehicle traffic will affect ambient air quality? Does ambient air quality comply with the country's ambient air quality standards? (2) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(1) No air quality standard has been established. Influences of air pollution from large trucks is assumed. (2) There are plants on the Gogecha and Modjo Bridge sites, which are not likely to worsen air pollution in consideration of their scale.
	(2) Water Quality	(1) 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? (2) Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? (3) 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?	(1) There is water quality degradation but no soil runoff because the two bridges have geological features of bedrock or horizontal sedimentary rock layer. (2) There is little contamination but negligible. (3) Not applicable.
	(3) Noise and Vibration	(1) Do noise and vibrations from vehicle and train traffic comply with the country's standards?	No standard has been established. However, prevention of generation of noise and vibrations from overloaded trucks should be examined in the future.
3 Natural Environment	(1) Protected Areas	(1) 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?	None of the two bridge sites is located in a protected area.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations Two bridges (Gogecha and Modjo Bridges)
3 Natural Environment	(2) Ecosystem	(1) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (2) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (3) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (4) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (5) Is there a possibility that installation of 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? (6) 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?	Not applicable.
	(3) Hydrology	(1) If creation activities of bridges and access roads, etc. adversely affect the flow of surface or underground water? (2) Is there any possibility that the installation of foundation leads to sediment discharge when constructing bridges?	(1) (2) There is no influence because the bridge foundation construction of two bridges is done above the estimated high water level. (2) There is no possibility but the issue will be examined in design.
	(4) Topography and Geology	(1) 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? (2) 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? (3) 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?	(1) The sites of the two bridges are not soft ground but bedrock or horizontal sedimentary rock layer. (2) The cutting and banking slopes shall be thoroughly examined. (3) Adequate measures shall be taken to prevent soil runoff during construction or after opening to traffic

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations Two bridges (Gogecha and Modjo Bridges)
4 Social Environment	(1) Resettlement	(1) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (2) Is adequate explanation on relocation and compensation given to affected persons prior to resettlement? (3) Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (4) Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (5) Are agreements with the affected persons obtained prior to resettlement? (6) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (7) Is a plan developed to monitor the impacts of resettlement?	(1) Yes but there is little impact because two of the bridges will reconstructed from the existing bridges. (2) Already explained in the two consultations. (3) The Abbreviated Resettlement Assistance Program (ARAP) has been established. (4) There is no applicable person. (5) Can be obtained. (6) Yes. The budget is applied for in February every year. (7) Described in the IEIA report.
	(2) Living and Livelihood	(1) Where roads or railways 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? (2) Is there a 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? (3) Is there a possibility that diseases, including communicable diseases, such as HIV will be introduced due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (4) Is there a possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)? (5) Is there a possibility that roads and railways will cause impede the movement of inhabitants? (6) Is there a possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?	(1)/(2) There is little adverse impact on the residents. (3) The lodging for construction workers shall be managed. (4) Both will happen during construction, so traffic safety management shall be conducted. (5) Impact on donkey trains that cross Modjo Bridge to go to the market during construction. Traffic control shall be conducted. (6) No.
	(3) Heritage	(1) 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?	No heritage or cultural asset is distributed in the two bridge sites. Any heritage found shall be reported to the Ministry of Youth, Sports, and Culture to consult about handling of them.
	(4) Landscape	(1) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	No adverse affect is expected but a bridge design not in harmony with the surrounding shall be avoided.
	(5) Ethnic Minorities and Indigenous Peoples	(1) Where ethnic minorities and indigenous peoples are living in the rights-of-way, are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples? (2) Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples?	Ethiopia is a multiethnic country. Mainly the Oromo people live around the Gogecha and Modjo Bridge sites. No particular ethnic minority or indigenous people live in these areas.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
			Two bridges (Gogecha and Modjo Bridges)
5 Others	(1) Impacts during Construction	(1) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (2) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (3) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (4) If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	(1) to (4) The construction specification shall require the contractor to submit an environmental management plan (EMP) and, after examination in collaboration with ERA, the contractor's compliance with the approved EMP shall be ensured. Monitoring shall be conducted under the responsibility of ERA.
	(2) Monitoring	(1) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (2) Are the items, methods and frequencies included in the monitoring program judged to be appropriate? (3) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (4) 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?	(1) to (4) The monitoring is conducted in accordance with the environmental rules of ERA, but the details are not clear and must be checked.
6 Note	Reference to Checklist of Other Sectors	(1) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (2) 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).	(1), (2) Not applicable.

Chapter 2 Outline Design of the Requested Japanese Assistance

2-1 Design Policies

Regarding the bridges located on A1 Trunk Road, Gogecha and Modjo Bridges are significantly deteriorated and damaged and face the risk of falling. To solve these problems, this project reconstructs Gogecha and Modjo Bridges and access roads in order to promote traffic and exchange between Ethiopia and neighboring countries, implement functions of an international trunk road, and contribute to the development of local economy. The project shall be planned based on the Ethiopian government's request, field reconnaissance, and consultation results in accordance with the policies described hereafter.

2-1-1 Basic Policies

The design policies for the outline design shall be as follows:

(1) Scope of cooperation

A formal request for grant aid cooperation regarding this project was submitted by Ethiopia to the Embassy in 2008.

Although this preparatory survey was implemented to reconfirm the content of the request and confirm mainly the bridge positions, access roads, bridge and access road longitudinal profile plan, width configuration, Bridge types, environment-related procedures, natural conditions, etc. As a result of consultation with Ethiopia, the principal content of the request for grant aid cooperation of the donor country was finally confirmed to be as follows:

- Reconstruction of Gogecha Bridge (two lanes with sidewalks) (current bridge position)
- Reconstruction of Modjo Bridge (two lanes with sidewalks) (current bridge position)
- Bank protection work (Gogecha and Modjo Bridges)
- Removal of existing bridges (Gogecha and Modjo Bridges)

(2) Bridge construction positions and access roads

1) Gogecha Bridge

As the bridge position of Gogecha Bridge, the following three alternatives shall be compared to select the most appropriate one.

- Alternative 1 (50 m upstream shift): Shift by about 50 meters to the upstream side (north side) of the current bridge.
- Alternative 2 (current bridge position): Reconstruction at the current bridge position.
- Alternative 3 (50 m downstream shift): Shift by about 50 meters to the downstream side (north side) of the current bridge.

2) Modjo Bridge

As the bridge position of Modjo Bridge, the following three alternatives shall be compared to select the most appropriate one.

- Alternative 1 (40 m upstream shift): Shift by about 40 meters to the upstream side (north side) of the current bridge.
- Alternative 2 (current bridge position): Reconstruction at the current bridge position.
- Alternative 3 (40 m downstream shift): Shift by about 40 meters to the downstream side (north side) of the current bridge.

(3) Detours

1) Gogecha Bridge

As the detour to Gogecha Bridge, the following three alternatives shall be compared to select the most appropriate one.

- Alternative 1 (upstream detour): Detour at about 25 meters on the upstream side (north side) of the current bridge.
- Alternative 2 (downstream detour): Detour at about 25 meters on the downstream side (south side) of the current bridge.
- Alternative 3 (use of Former A1 Trunk Road as detour): Use of Former A1 Trunk Road as a detour.

2) Modjo Bridge

As the detour to Modjo Bridge, the following three alternatives shall be compared to select the most appropriate one.

- Alternative 1 (upstream detour): Detour at about 25 meters on the upstream side (north side) of the current bridge.
- Alternative 2 (downstream detour): Detour at about 25 meters on the downstream side (south side) of the current bridge.
- Alternative 3 (use of Former A1 Trunk Road as detour): Use of Former A1 Trunk Road as a detour.

(4) Scale, etc.

1) Span length

The span length can be obtained using the following formula:

Span length L＝20+0.005Q＝20+0.005×1200m3/sec

where Q is a design flood discharge.

2) Scope of cooperation for access roads

If the construction position of Gogecha or Modjo Bridge is shifted to the upstream or downstream side of the current bridge position, a new access road is needed for the section connecting the new bridge to the current road. If the reconstruction is conducted at the current bridge position, an access road is needed only for the restored part of the current road behind the bridge abutment.

These access roads shall be constructed by grant aid cooperation of the donor country.

(5) Request content and consultation/check items

The outline design shall be promoted under the conditions mutually checked by the two countries and the survey team. Table 2-1-1 and Table 2-1-2 show the request content and consultation and check items in the preparatory survey.

Table 2-1-1 Request content and consultation/check items (Gogecha Bridge)

Item		Request content	Consultation/check items
Target bridge		Reconstruction of Gogecha Bridge	Reconstruction of Gogecha Bridge
Construction position		Not specified	The following three alternatives shall be compared to select the most appropriate one. ・ Alternative 1: 50 m upstream shift ・ Alternative 2: Current bridge position ・ Alternative 3: 50 m downstream shift
Bridge type and length		RC2 span simply supported girder bridge (L=2@19.0m=38.0m) (Existing bridge)	The following three alternatives shall be compared to select the most appropriate one. ・ Alternative 1: Simply post-tensioned T-girder bridge ・ Alternative 2: PC 2-span continuous post-tensioned T-girder bridge ・ Alternative 3: Steel simply non-composite I-girder bridge
Width	Effective width	8.1m (Existing bridge)	13.3m
	Carriageway	3.65m×2=7.3m (Existing bridge)	3.65m×2=7.3m
	Shoulder	0.4m×2=0.8m (Existing bridge)	0.5m×2=1.0m
	Sidewalk	None (Existing bridge)	2.5m×2=5.0m
Number of lanes		2 lanes (Existing bridge)	2 lanes
Design speed		Not specified	50km/h
Design live load		As above	Load increased by 25% from HS20 in AASHTO Standard
Access road		As above	Restoration of the current road behind the bridge abutment after it is constructed
Bank protection work		As above	Front of bridge abutment

Table 2-1-2 Request content and consultation/check items (Modjo Bridge)

Item		Request content	Consultation/check items
Target bridge		Reconstruction of Modjo Bridge	Reconstruction of Modjo Bridge
Construction position		Not specified	The following three alternatives shall be compared to select the most appropriate one. ・ Alternative 1: 40 m upstream shift ・ Alternative 2: Current bridge position ・ Alternative 3: 40 m downstream shift
Bridge type and length		RC 3-span continuous girder bridge + RC simple girder bridge (L=22.5+31.1+22.5+14.4 =90.5m) (Existing bridge)	The following three alternatives shall be compared to select the most appropriate one. ・ Alternative 1: PC 3-span continuous simply post-tensioned T-girder bridge ・ Alternative 2: PC 3-span continuous box-girder bridge ・ Alternative 3: Concrete arch bridge
Width	Effective width	8.1m (Existing bridge)	13.3m
	Carriageway	3.65m×2=7.3m (Existing bridge)	3.65m×2=7.3m
	Shoulder	0.4m×2=0.8m (Existing bridge)	0.5m×2=1.0m
	Sidewalk	None (Existing bridge)	2.5m×2=5.0m
Number of lanes		2 lanes (Existing bridge)	2 lanes
Design speed		Not specified	50km/h
Design live load		As above	Load increased by 25% from HS20 in AASHTO Standard
Access road		As above	Restoration of the current road behind the bridge abutment after it is constructed
Bank protection work		As above	Around bridge piers

2-1-2 Policies on Natural Environmental Conditions

(1) Meteorology

1) Temperature, wind speed, and humidity

i) Gogecha Bridge

In the vicinity of Gogecha Bridge, the maximum temperature is the highest in March, 23.7℃ on the average of 11 years, and the minimum temperature from December to February is about 9℃ on the average of 11 years. The average temperature throughout the year is 15℃ to 19℃. The wind speed throughout the year is 3.5 m/s to 5.4 m/s, becoming higher in October through March in the dry season. The year-round average wind speed is 4.5 m/s, not particularly high. The humidity is the highest at 77% in July and August in the rainy season, and is the lowest at 47% in November in the dry season. The year-round average humidity is about 59%.

In this area, none of the temperature, humidity, and wind speed is particularly high. Therefore, these natural conditions will not have a particular impact on design or construction.

ii) Modjo Bridge

In the vicinity of Modjo Bridge, the maximum temperature is the highest at 22℃ in April and May, and the minimum temperature from November to January is about 9℃ on the average of 11 years. The average temperature throughout the year is 20℃. The wind speed throughout the year is 2.2 m/s to 3.6 m/s, becoming higher in October through March in the dry season. The year-round average wind speed is 2.9 m/s. The humidity is the highest at 74% in August in the rainy season, and is the lowest at 40% in November in the dry season. The year-round average humidity is about 54%.

In this vicinity of Modjo Bridge, like that of Gogecha Bridge, none of the temperature, humidity, and wind speed is particularly high. Therefore, these natural conditions will not have a particular impact on design or construction.

2) Precipitations and rainfall patterns

i) Gogecha Bridge

The annual precipitation at this point is 1,064 mm on the average of five years, and ranges from around 950 mm at the lowest to around 1,200 mm at the highest, showing a small difference between years. Generally, the rainy season in Ethiopia is from mid-June to mid-September whereas the dry season is from mid-September to mid-June.

In the areas where the bridges are to be constructed, there is a clear distinction between the rainy and dry seasons, and most of the rainfall is concentrated on the rainy season (mid-June to mid-September). These meteorological records have a significant impact on the construction plans and process plans, due consideration must be paid to these meteorological conditions when making these plans. In particular, an attempt shall be made to complete the construction work in the river during the dry season, such as the bridge pier substructure construction and foundation construction.

ii) Modjo Bridge

The annual precipitation at this point is 1,252 mm on the average of five years, and ranges from around 980 mm at the lowest to around 1,520 mm at the highest, showing a small difference between years. The precipitation in July and August is the highest throughout the year and falls to nearly zero in November to February.

As for Gogecha Bridge, an attempt shall be made to complete the construction work in the river during the dry season, such as the bridge pier substructure construction and foundation construction.

(2) Scouring and substructure installation depth

The height of the bridge pier foundation shall be determined in consideration of scouring by the bridge piers. The Japanese standards specify securing of a scouring depth of 2.0 m or more from the design riverbed or the deepest riverbed, whichever is lower. In this project, however, the bridge pier footing shall have a setting depth of 2.0 m or more from the deepest riverbed or set in the bedrock. As for the bridge abutment in the case of spread foundation, the footing base shall be set to a sufficient depth in a good bearing layer such as the bedrock, mudstone, and gravel. As required, embedment work shall be installed.

(3) Seismic design

In the central part of Ethiopia, the African Great Rift Valley runs from the northeast to the southwest and is a high volcanic activity area. In Ethiopia, volcanic activities started about 40 million years ago, leaving fresh volcanic features in the Valley, and still continue up to the present. This area is characterized by diverse rocks, eruption patterns, and eruption-level activities in different geological ages, tensile stress fields, and frequent occurrence of seismic activities. The Rift Valley is a normal fault with a width of 35 to 100 km and a total extension of 7,000 km, dotted everywhere with earth fissures and bluffs with a drop of more than 100 m.

The bridge design standards of Ethiopia specify the horizontal seismic coefficient to be adopted in a seismic design for each of the areas and structural characteristics. Since the target bridges in this project are located on the Rift Valley, the design horizontal seismic coefficient shall be calculated and a seismic design shall be made in consideration of structural characteristics.

2-1-3 Policies on Traffic Volumes

(1) Basic policies on traffic demand forecasting

In 2005, Africon implemented F/S on the Addis-Adama Expressway and conducted a traffic demand forecasting in it. Then, in 2007, Scott Willson of the U.K. reviewed this F/S, re-examined detailed conditions, and conducted the latest traffic demand forecasting as of the present time. According to the hearing survey on ERA, no toll system has been finalized yet. The future traffic volume of A1 Trunk Road, the target road in this project that runs in parallel to the Expressway, will largely depend on the road improvement cases and toll settings of the latter.

In this report, future traffic volumes in the vicinity of the target bridges shall be set based on the latest version of data available at the time of field reconnaissance. However, it is advisable to update the design traffic volumes in accordance with the latest information available in the detailed design phase.

Demand forecasting period

2010 to 2030

Toll charging scheme

- Scheme 1: Tolls charged from the start of service
- Scheme 2: Toll-free initially and tolls charged later in consideration of influences

Road improvement cases under examination

- Scenario 1: Only the first stage with an extremely high traffic volume at present, from Addis Ababa to the southern side of Debre Zeyit, shall be improved.
- Scenario 2: All the route from Addis Ababa to Adama (all of the first to third stages) shall be open to traffic at once.

Toll setting

- Free: No toll is collected.
- Option 1 Low toll setting: The toll is about half the normal setting.
- Option 2 Normal setting: The toll to be collected is set in accordance with willingness-to-pay analysis.

The future traffic volume setting for the target section shall be set appropriately in view of future trends of the expressway plan while paying considerations to securing of redundancy.

Gogecha bridge

		No EXP improvement	Scenario 1 (Improvement up to Debre Zeit (south))										Scenario 2 (Improvement of all the route)									
			No Toll		Regime 1				Regime 2				No Toll		Regime 1				Regime 2			
					Low Case		Central Case		Low Case		Central Case				Low Case		Central Case		Low Case		Central Case	
		Traffic volume	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share
2010	EXP		7,604	58.1%	2,759	28.8%	0	0.0%	3,241	35.7%	1,998	22.9%	7,604	75.4%	3,708	41.8%	659	8.0%	4,562	51.9%	2,964	34.6%
	AI	10,480	5,484	41.9%	6,808	71.2%	7,615	100.0%	5,829	64.3%	6,717	77.1%	2,476	24.6%	5,173	58.2%	7,620	92.0%	4,226	48.1%	5,608	65.4%
2020	EXP		14,436	76.0%	9,699	56.3%	5,630	37.9%	11,193	64.2%	9,007	55.2%	14,436	76.1%	10,498	61.5%	7,197	44.1%	11,764	65.3%	10,782	62.7%
	AI	19,668	4,553	24.0%	7,537	43.7%	9,238	62.1%	6,238	35.8%	7,322	44.8%	4,536	23.9%	6,565	38.5%	9,126	55.9%	6,242	34.7%	6,424	37.3%
2030	EXP		22,895	77.3%	19,105	70.8%	14,349	60.3%	18,805	71.1%	17,898	69.7%	22,894	77.3%	18,655	70.3%	15,283	61.9%	18,808	71.1%	18,396	70.3%
	AI	29,633	6,738	22.7%	7,872	29.2%	9,431	39.7%	7,659	28.9%	7,780	30.3%	6,711	22.7%	7,863	29.7%	9,418	38.1%	7,650	28.9%	7,783	29.7%

↑Maximum for cross-section ↑Maximum for existing roads ↑Minimum for existing roads

Modjo bridge

		No EXP improvement	Scenario 1 (Improvement up to Debre Zeit (south))										Scenario 2 (Improvement of all the route)									
			No Toll		Regime 1				Regime 2				No Toll		Regime 1				Regime 2			
					Low Case		Central Case		Low Case		Central Case				Low Case		Central Case		Low Case		Central Case	
		Traffic volume	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share	Traffic volume	Share
2010	EXP			0.0%		0.0%		0.0%		0.0%		0.0%	3,202	62.7%	3,202	62.7%	1,383	30.3%	3,202	62.7%	3,202	62.7%
	AI	7,263	3,876	100.0%	3,860	100.0%	3,890	100.0%	3,954	100.0%	3,876	100.0%	1,904	37.3%	1,904	37.3%	3,186	69.7%	1,904	37.3%	1,904	37.3%
2020	EXP			0.0%		0.0%		0.0%		0.0%		0.0%	6,112	58.6%	6,112	59.0%	5,943	57.8%	6,112	58.7%	6,112	59.0%
	AI	13,760	7,873	100.0%	7,874	100.0%	7,881	100.0%	7,755	100.0%	7,919	100.0%	4,325	41.4%	4,249	41.0%	4,346	42.2%	4,293	41.3%	4,253	41.0%
2030	EXP			0.0%		0.0%		0.0%		0.0%		0.0%	9,317	58.9%	9,317	59.2%	9,138	58.2%	9,317	59.0%	9,317	59.3%
	AI	20,854	11,300	100.0%	11,446	100.0%	11,763	100.0%	11,910	100.0%	11,431	100.0%	6,491	41.1%	6,410	40.8%	6,554	41.8%	6,463	41.0%	6,382	40.7%

↑Maximum for existing roads ↑Maximum for cross-section Minimum for existing roads↑

Table 2-1-3 Traffic demand forecast for Addis-Adama Expressway

(2) Overview of traffic volumes

- Overview of traffic volumes of pedestrians and bicycles

  Gogecha and Modjo Bridges have a high pedestrian traffic demand. As for Modjo Bridge, a market is held in Modjo Town near the bridge on Tuesday and Saturday, when there is a high market-bound traffic of pedestrians walking over the bridge and donkeys carrying goods.

- Cross-section (both-way) traffic volume

  The daily traffic volume of Gogecha Bridge is 11,200 vehicles on a weekday and 10,200 vehicles on a holiday. The daily traffic volume of Modjo Bridge is 8,100 vehicles on a weekday and 7,500 vehicles on a holiday.

- Large vehicle mixing ratio

  For Gogecha and Modjo Bridges, the large vehicle mixing ratio is around 15% to 25% and tends to be a little lower on holidays.

- Ratio of daily traffic to daytime traffic

  The ratio of daily traffic to daytime traffic (24-hour traffic volume divided by 12-hour traffic volume in the daytime) is around 1.3 to 1.4 for Gogecha and Modjo Bridges.

(3) Future traffic volume estimate

1) Gogecha Bridge

The future traffic volume of Gogecha Bridge will be significantly influenced by the traffic volume of the Addis-Adama Expressway that runs in parallel with it. Therefore, a safe-side plan shall be made for the traffic volumes of 2010, 2020, and 2030 by making them consistent with the A1 traffic volume that is the maximum value in each examination case shown in the Addis-Adama Expressway F/S Report. The traffic volumes in the intermediate years shall be complemented using each of the annual growth rates shown below.

As classifications by vehicle type, the total traffic volume shown in the F/S report shall be proportionally divided by the mixing ratios of each vehicle type observed in the current survey.

Table 2-1-4 Base year traffic volumes and mixing ratios by vehicle type

		Car	S.Wagon & Pickup	S/Bus [<27 seat]	L/Bus [>27 seat]	S/Truck [< 30 Qt]	M/Truck [30-70 Qt]	H/Truck [>70 Qt]	T & T
Mix rate (%)		14.7%	18.3%	21.7%	2.3%	16.3%	5.6%	11.5%	9.5%
2010	7,620	1,122	1,396	1,653	175	1,245	424	879	726
2020	9,238	1,361	1,692	2,004	212	1,509	514	1,066	880
2030	9,431	1,389	1,728	2,045	217	1,541	525	1,088	898

Table 2-1-5 Growth rates of traffic volumes

	cars	buses	trucks
2007-2010	4.2	3.9	5.3
2011-2013	5.6	5.2	7.1
2014-2020	7.0	6.5	8.9
2021-2030	4.2	3.9	5.3

Source: Scott Willson F/S Report

From the conditions shown above, the traffic volumes 20 years later (2030) are estimated as shown in the table below.

Table 2-1-6 Future traffic volume estimates (Gogecha Bridge)

Vehicles per day, both ways

Annual	Year	traffic growth rates			Number of traffic(AADT1)								Total
		cars %	buses %	trucks %	Car	S.Wagon & Pickup	S/Bus [<27 seat]	L/Bus [>27 seat]	S/Truck [< 30 Qt]	M/Truck [30-70 Qt]	H/Truck [>70 Qt]	T & T	
Present	2010	4.2	3.9	5.3	1,122	1,396	1,653	175	1,245	424	879	726	7,620
1	2011	5.6	5.2	7.1	1,170	1,455	1,717	182	1,311	447	926	764	7,971
2	2012	5.6	5.2	7.1	1,235	1,536	1,806	191	1,404	478	992	818	8,461
3	2013	5.6	5.2	7.1	1,304	1,622	1,900	201	1,504	512	1,062	876	8,982
4	2014	7.0	6.5	8.9	1,377	1,713	1,999	212	1,610	549	1,138	939	9,536
5	2015	7.0	6.5	8.9	1,474	1,833	2,129	225	1,754	597	1,239	1,022	10,273
6	2016	7.0	6.5	8.9	1,577	1,961	2,267	240	1,910	651	1,349	1,113	11,068
7	2017	7.0	6.5	8.9	1,687	2,098	2,415	256	2,080	708	1,469	1,212	11,926
8	2018	7.0	6.5	8.9	1,805	2,245	2,572	272	2,265	771	1,600	1,320	12,851
9	2019	7.0	6.5	8.9	1,932	2,403	2,739	290	2,466	840	1,742	1,438	13,850
10	2020	7.0	6.5	8.9	1,361	1,692	2,004	212	1,509	514	1,066	880	9,238
11	2021	4.2	3.9	5.3	1,456	1,811	2,134	226	1,644	560	1,161	958	9,949
12	2022	4.2	3.9	5.3	1,517	1,887	2,217	235	1,731	590	1,223	1,009	10,407
13	2023	4.2	3.9	5.3	1,581	1,966	2,303	244	1,822	621	1,287	1,062	10,887
14	2024	4.2	3.9	5.3	1,647	2,049	2,393	253	1,919	654	1,356	1,118	11,389
15	2025	4.2	3.9	5.3	1,716	2,135	2,487	263	2,021	688	1,427	1,178	11,915
16	2026	4.2	3.9	5.3	1,789	2,225	2,584	273	2,128	725	1,503	1,240	12,466
17	2027	4.2	3.9	5.3	1,864	2,318	2,684	284	2,241	763	1,583	1,306	13,043
18	2028	4.2	3.9	5.3	1,942	2,415	2,789	295	2,359	804	1,667	1,375	13,646
19	2029	4.2	3.9	5.3	2,023	2,517	2,898	307	2,484	846	1,755	1,448	14,278
20	2030	4.2	3.9	5.3	1,389	1,728	2,045	217	1,541	525	1,088	898	9,431

2) Modjo Bridge

The future traffic volume of Modjo Bridge, as that of Gogecha Bridge, will be significantly influenced by the traffic volume of the Addis-Adama Expressway that runs in parallel with it. Therefore, a safe-side plan shall be made for the traffic volumes of 2010, 2020, and 2030 by making them consistent with the A1 traffic volume that is the maximum value in each examination case shown in the Addis-Adama Expressway F/S Report. The traffic volumes in the intermediate years shall be complemented using each of the annual growth rates shown below.

As classifications by vehicle type, the total traffic volume shown in the F/S report shall be proportionally divided by the mixing ratios of each vehicle type observed in the current survey.

Table 2-1-7 Base year traffic volumes and mixing ratios by vehicle type

		Car	S.Wagon & Pickup	S/Bus [<27 seat]	L/Bus [>27 seat]	S/Truck [< 30 Qt]	M/Truck [30-70 Qt]	H/Truck [>70 Qt]	T & T
Mix rate (%)		12.3%	15.8%	21.9%	2.4%	18.1%	5.9%	10.7%	13.0%
2010	3,954	487	625	865	94	714	232	425	512
2020	7,881	971	1,245	1,723	188	1,423	462	847	1,021
2030	11,910	1,468	1,882	2,604	284	2,151	698	1,280	1,544

Table 2-1-8 Growth rates of traffic volumes

	cars	buses	trucks
2007-2010	3.3	3.8	4.4
2011-2013	4.4	5.0	5.9
2014-2020	5.5	6.3	7.4
2021-2030	3.3	3.8	4.4

Source: Scott Willson F/S Report

From the conditions shown above, the traffic volumes 20 years later (2030) are estimated as shown in Table 2-1-9.

Table 2-1-9 Future traffic volume estimates (Modjo Bridge)

Vehicles per day, both ways

Annual	Year	traffic growth rates			Number of traffic (AADT1)								Total
		cars %	buses %	trucks %	Car	S.Wagon & Pickup	S/Bus [<27 seat]	L/Bus [>27 seat]	S/Truck [< 30 Qt]	M/Truck [30-70 Qt]	H/Truck [>70 Qt]	T & T	
Present	2010	3.3	3.8	4.4	487	625	865	94	714	232	425	512	3,954
1	2011	4.4	5.0	5.9	503	645	897	98	745	242	444	535	4,110
2	2012	4.4	5.0	5.9	525	674	942	103	789	256	470	567	4,326
3	2013	4.4	5.0	5.9	549	703	989	108	836	271	498	600	4,554
4	2014	5.5	6.3	7.4	573	734	1,039	113	885	287	527	635	4,794
5	2015	5.5	6.3	7.4	604	775	1,104	120	951	309	566	682	5,111
6	2016	5.5	6.3	7.4	637	817	1,174	128	1,021	331	608	733	5,450
7	2017	5.5	6.3	7.4	672	862	1,248	136	1,097	356	653	787	5,811
8	2018	5.5	6.3	7.4	709	910	1,327	145	1,178	382	701	845	6,197
9	2019	5.5	6.3	7.4	748	960	1,410	154	1,265	411	753	908	6,609
10	2020	5.5	6.3	7.4	971	1,245	1,723	188	1,423	462	847	1,021	7,881
11	2021	3.3	3.8	4.4	1,024	1,314	1,832	200	1,529	496	910	1,097	8,401
12	2022	3.3	3.8	4.4	1,058	1,357	1,902	207	1,596	518	950	1,145	8,733
13	2023	3.3	3.8	4.4	1,093	1,402	1,974	215	1,666	541	992	1,196	9,078
14	2024	3.3	3.8	4.4	1,129	1,448	2,049	223	1,739	564	1,035	1,248	9,437
15	2025	3.3	3.8	4.4	1,167	1,496	2,127	232	1,816	589	1,081	1,303	9,810
16	2026	3.3	3.8	4.4	1,205	1,545	2,207	241	1,896	615	1,128	1,361	10,198
17	2027	3.3	3.8	4.4	1,245	1,596	2,291	250	1,979	642	1,178	1,420	10,602
18	2028	3.3	3.8	4.4	1,286	1,649	2,378	259	2,066	670	1,230	1,483	11,022
19	2029	3.3	3.8	4.4	1,328	1,703	2,469	269	2,157	700	1,284	1,548	11,459
20	2030	3.3	3.8	4.4	1,468	1,882	2,604	284	2,151	698	1,280	1,544	11,910

3) Summary of design traffic volumes

From the above estimation results, the design traffic volumes 20 years later (2030) for the bridges are as follows:

Table 2-1-10 Design traffic volumes

Site	Design traffic volume (vehicles/day)	Remarks
Gogecha Bridge	9,431	Running in parallel with the Addis - Adama Expressway
Modjo Bridge	11,910	Running in parallel with the Addis - Adama Expressway

(4) Road standard

From the above design traffic volumes, the standard of roads near the target bridges under survey shall be set as shown below.

The road standard shall be set in accordance with the Ethiopian manual, "Geometric Design Manual 2002 (ERA)."

Table 2-1: Design Standards vs. Road Classification and AADT

Road Functional Classification	Design Standard	Design Traffic Flow (AADT)*	Surface Type	Width (m)		Design Speed (km/hr)				Urban/Peri-Urban
				Carriageway	Shoulder	Flat	Rolling	Mountainous	Escarpment	
TRUNK	DS1	10000–**15000	Paved	***Dual 2 x 7.3	See T.2-2	120	100	85	70	50
LINK	DS2	5000–10000	Paved	7.3	See T.2-2	120	100	85	70	50
MAIN ACCESS	DS3	1000–5000	Paved	7.0	See T.2-2	100	85	70	60	50
	DS4	200–1000	Paved	6.7	See T.2-2	85	70	60	50	50
COLECTORS	DS5	100– 200	Unpaved	7.0	See T.2 -2	70	60	50	40	50
	DS6	50–100	Unpaved	6.0	See T.2-2	60	50	40	30	50
FEEDER	DS7	30–75	Unpaved	4.0	See T.2-2	60	50	40	30	50
	DS8	25–50	Unpaved	4.0	See T.2-2	60	50	40	30	50
	DS9	0–25	Unpaved	4.0	See T.2-2	60	40	30	20	40
	DS10	0–15	Unpaved	3.3	See T.2-2	60	40	30	20	40

From the above, the roads before and after the bridge including the bridge shall be designed in accordance with the road standard shown below.

Table 2-1-11 Road standard

Sites	Road standard	Topographical type	Design speed	Remarks
Gogecha Bridge	DS2	Urban/Peri-urban	50km/h	
Modjo Bridge	DS2	Urban/Peri-urban	50km/h	

2-1-4 Policies on Bridge and Road Widths

The bridge and access bridge widths shall also be set in accordance with the standard widths by road standards stipulated in "Geometric Design Manual 2002 (ERA)" shown below.

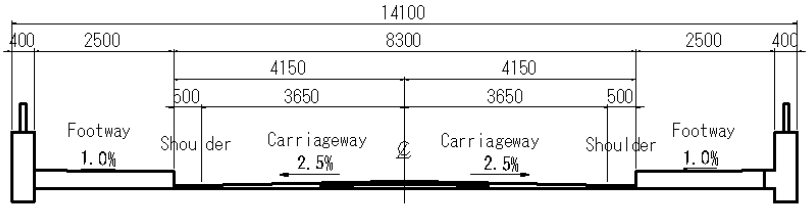
Table 2-1-12 Shoulder widths by road standards

Design Standard	Rural Terrain/Shoulder Width (m)				Town Section Widths (m)			
	Flat	Rolling	Mountainous	Escarpment	Shoulder	Parking Lane***	Foot way	Median!
DS1	3.0	3.0	0.5 – 2.5	0.5 – 2.5	n/a	3.5	2.5 (min)	5.0 (min)
DS2	3.0	3.0	0.5 – 2.5	0.5 – 2.5	n/a	3.5	2.5	Barrier!
DS3	1.5 - 3.0++	1.5 - 3.0++	0.5 – 1.5	0.5 – 1.5	n/a	3.5	2.5	n/a
DS4	1.5	1.5	0.5	0.5	n/a	3.5	2.5	n/a
DS5*	0.0	0.0	0.0	0.0	n/a	3.5+++	2.5	n/a
DS6**	0.0	0.0	0.0	0.0	n/a	3.5+++	2.5	n/a
DS7	1.0 (earth)	1.0 (earth)	1.0 (earth)	1.0 (earth)	n/a	n/a +	n/a +	n/a
DS8**	0.0	0.0	0.0	0.0	n/a	n/a +	n/a +	n/a
DS9**	0.0	0.0	0.0	0.0	n/a	n/a +	n/a +	n/a
DS10**	0.0	0.0	0.0	0.0	n/a	n/a +	n/a +	n/a

- Carriageway: All the sections fall into either DS1 or DS2 standard, the carriageway width shall be 7.3/2 = 3.65 m. Although Modjo Bridge is DS1 type that has basically four lanes with a median zone according to the Manual, it shall be planned as a two-lane road in this project because the influence by the Addis-Adama Expressway is unknown and the A1 Trunk Road is currently a two-lane road.
- Shoulder: For Awash Bridge, the topographical type is "Mountainous" with a specified width of 0.5 to 2.5 m, and the shoulder width of 2.5 m shall be secured because relatively large cutting will be made in the access roads and the consistency with the road sections before and after the bridge need to be maintained.

・ Sidewalk: No sidewalk shall be basically constructed on Awash Bridge because there is little pedestrian traffic demand and the existing bridge shall be retained.

Gogecha and Modjo Bridges (with sidewalks)



Access roads

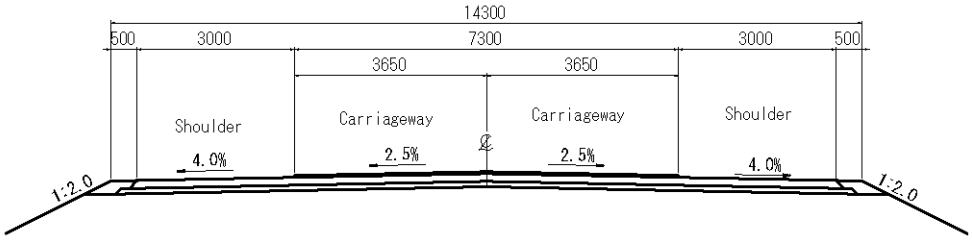


Figure 2-1-1 Widths of bridge and access roads

2-1-5 Policies on Design Live Loads

In Ethiopia, Bridge Design Manual:2002, a bridge design standard based on the American Association of State Highway and Transportation Officials (AASHTO) standard, has been established. This Ethiopian standard specifies that HS20 (total weight of 32.6 tons) shall be applied as the design live load of a bridge on a principal trunk road. Actually, however, heavy vehicles exceeding the design live load HS20 are running on the principal trunk roads of Ethiopia. Therefore, a load increased by 25% from this design live load HS20 (total weight of 40.8 tons) shall be applied to the design of bridges in this project.

The following figure shows the load of HS20.

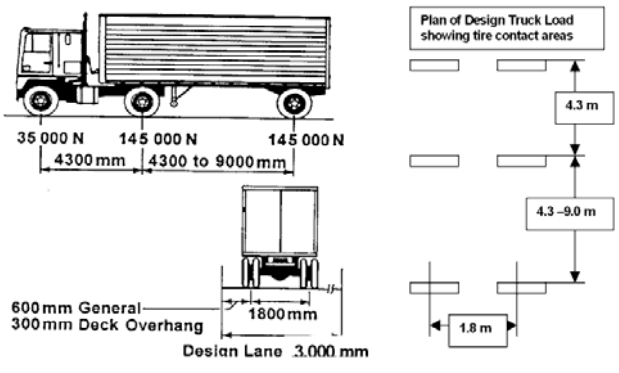


Figure 3-4 Characteristics of the Design Truck

Figure 2-1-2 Live load (HS20)

2-1-6 Policies on Socio-economic Conditions

The consideration items and countermeasures needed in planning, design, and construction of the target bridges in the cooperation project are as follows:

① Emission of dust during construction: Countermeasures against dust such as water spray shall be taken.
② Emission of noise and vibration during construction: A construction method with as little noise and vibration as possible shall be adopted.
③ Discharge of contaminants (such as spillage of oil, etc.): Measures against discharge of contaminants shall be taken.
④ Soil runoff and river pollution: Measures against soil runoff and river water pollution shall be taken.
⑤ Obstruction to general traffic: Safety education shall be provided to construction vehicle drivers.
⑥ Measures required for borrow pits and stone pits: As a borrow pit, a place with little environmental load shall be selected. As a stone pit, an existing stone pit shall be used whenever possible to avoid collecting aggregate from a new place.
⑦ Occurrence of accidents: Safety and health education to construction personnel shall be ensured to prevent occurrence of accidents.

It has been confirmed that no resettlement of residents is needed in the scope of this project.

2-1-7 Policies on Construction Circumstances

(1) Labor status

In Ethiopia, there are construction companies, technicians, and workers with experience in bridge construction in grant aid cooperation, but they are few in number and have few track records. In paticular, there are very few persons with construction technologies and experiences in prestressed concrete (PC) bridge construction. Therefore, the basic policy shall be as follows: The work types that require advanced technology and the work types for which there are few track records shall be assigned to engineers dispatched from the donor country, and for other work types, the local technical capabilities and labor forces shall be utilized wherever possible.
As in the past grant aid projects, workers can be procured in Ethiopia. However, most of the skilled workers belong to construction companies, each of which has its own specialty field. Therefore, it is important to check out and select appropriate ones.

(2) Material procurement status

1) Reinforcing bars, steel products, pre-stressed concrete steel

Although reinforcing bars are manufactured in Ethiopia, they have problems in quality. In consideration of the importance of the structures to build, reinforcing bars shall be procured from the donor country or third countries such as South Africa and Egypt. During design or procurement, due

attention must be paid to the diameters and lug geometries of reinforcing bars because there are difference in them between Ethiopia and the donor country.
Steel products such as steel plates and shapes shall be procured from the donor country or third countries such as South Africa and Egypt because none of them is manufactured in Ethiopia. PC steel materials can hardly be procured on the general market, and there is no facility with a reliable technology to process such products in Ethiopia. Therefore, import from the donor country shall be considered for PC steel materials to be used in this project by ordering them to specified import sources and manufacturers, i.e., taking a measure enabling quality check.

2) Bridge accessories

As in the past grant aid projects, it is advisable to procure bridge accessories from the donor country because, although some of them can be procured from neighboring countries, they have a problem in quality, etc.

3) Cement

Cement shall be purchased from Ethiopian manufacturers because it is prohibited to import cement into Ethiopia. At present, Mugher and Messebo are two oligopolistic companies with a total share of about 90% of the domestic market, and there is no choice but to purchase cement from them. In the hearing survey, it was learned that the products of these two companies do not have a difference in quality.
Although a full-fledged cement plant with Chinese capital funds is near completion, it has not reached a production or sales stage yet.

4) Asphalt concrete

No specialized manufacturer that owns an asphalt plant is found in the vicinity of the project sites. In Ethiopia, a paving contractor, under a contract with a building contractor, relocates a simple asphalt plant to near the site and produces asphalt while construction is in progress.

5) Aggregate

In the suburbs of Addis Ababa, stationary plants owned by several aggregate producers are in operation. For Gogecha and Modjo Bridges, therefore, subbase materials and concrete aggregates shall be purchased from aggregate production plants.

6) Banking material

Appropriation of materials excavated on each of the sites as banking materials shall be considered first. Since Gogecha Bridge will have little excavated materials, an option of purchasing materials from the nearby aggregate production plant shall be considered.

(3) Construction machinery procurement status

Although general construction machinery to be used for road repair, etc. are owned by ERA local offices and construction companies, procurement from The donor country shall be considered for large

cranes and cantilever erection machines, construction machines such as mixer trucks and concrete pump trucks for concrete casting, asphalt plants, concrete plants, and crusher plants for aggregate production.

Rental construction machinery can be rented from several companies in Addis Ababa, but no such company was found in the nearest city, Nazret, or near the sites. Regarding each of the rentable models, not so many machines are owned, and many users come to rent them at the start of the dry season. Nevertheless, procurement through renting shall be considered for such highly versatile machines as bulldozers, backhoes, and dump trucks.

There are asphalt cement plants and concrete plants owned by a major construction company in Addis Ababa, which also sells asphalt mixtures and ready-mixed concrete. However, the plants are not rented or leased.

Some crusher plants owned by several aggregate producers were found to be in operation near Addis Ababa but they are the stationary type for the companies' own use, and no plant that can be used for our procurement was found.

(4) Design and construction standards for roads and bridge

1) Road design and construction standards

Road design shall comply with the standards established in Ethiopia and, where there is insufficiency, comply with the donor country's standards. Therefore, the following design standards shall be used for road design:

- Geometric Design Manual 2002 (ERA)
- Drainage Design Manual 2002 (ERA)
- Pavement Design Manual 2002 (ERA)
- Standard Detail Drawings 2002 (ERA)

2) Bridge design and construction standards

The following design standards shall be applied to bridge design.

- Bridge Design Manual - 2002 (ERA)

The design live load on a bridge shall be set as a load increased by 25% from HS20 specified in the Ethiopian standard (Bridge Design Manual: 2002) based on AASHTO. However, the structural members of a bridge shall be designed using the allowable stress design method of the donor country.

2-1-8 Policies on Hiring of Local Contractors

An interview survey on the local contractors and building contractors in the surrounding countries found that the contractors in Ethiopia form a joint venture to participate as a subcontractor in the construction of bridge with long spans. A hearing survey on the local consultants revealed that they have a low technical level and perform a limited range of operations such as land survey, geological survey, traffic volume survey, and environmental survey.

2-1-9 Policies on Handling of Operation and Maintenance Abilities of Implementing Agencies

The road administration related to trunk roads in Ethiopia is under the charge of ERA, with its responsibilities and authorities legally stipulated. The former organization of ERA is the Imperial Highway Authority established in 1951. ERA was founded in 1978. The organizational reform in 1997 established its current organizational structure (See Figure 2-1 1, "ERA organization chart").

ERA's number of personnel is 18,372 (as of May 2010), including 2,942 working at the headquarters, 6,765 at local offices, and 8,665 in projects.

As for the organizational structure, ERA has three major departments: the Operation Department, the Engineering and Regulatory Department, and the Human Resource and Financial Department. The division of operations between these departments are as follows: The Operation Department implements construction work and maintenance/repair with ERA's own funds (ERA directly conducts 50% of periodical repair and 100% of daily maintenance/repair); the Engineering and Regulatory Department implements planning, design, and bid contracts and repair, construction, and maintenance management (mainly via outsourcing to the private sector); and the Human Resource and Financial Department is in charge of administrative operations, finance, and human affairs.

Since this project concerns reconstruction of the existing bridges, the requester was ERA's road and bridge maintenance/management department (Road Network Management Division of the Engineering and Regulatory Department). According to ERA, the project is handled by above Road Network Management Division in the preparatory survey phase, and will be handled by the Engineering Service Procurement and Design Division in the contractor tendering phase, and the maintenance/management after construction will be handled by the Road Network Management Division.

2-1-10 Policies on facility grade setting

The target bridges in this project, Gogecha and Modjo Bridges, are very important bridges because they are located on A1 Trunk Road, a principal road that runs through Ethiopia, as well as on an international trunk road that supports import and export between the capital Addis Abba of this inland country Ethiopia and the neighboring country Djibouti with an international port. The following grades shall be adopted.

① Design standards

- Road design: Shall comply with the Ethiopian design standards and, where there is insufficiency, comply with the donor country’s standards.
- Bridge design: When local materials are used, the design strength for them shall comply with the Ethiopian design standards. The design method shall comply with the donor country’s standards.

② Design live load

The design live load on a bridge shall be set as a load increased by 25% from HS20 specified in the Ethiopian standard (Bridge Design Manual: 2002) based on AASHTO.

③ Width

i） Bridges (with sidewalks)

Carriageway width 3.65m×2=7.3m, Shoulder width 0.5m×2=1.0m、Sidewalk 2.5m×2=5.0m Total 13.3 m (Effective width)

ii） Access road

Carriageway width 3.65m×2=7.3m, Shoulder 3.0m×2=6.0m Total 13.3 m (Effective width)

④ Road type

Trunk road (national road) DS2

⑤ Design speed

50 km/h

2-1-11 Policies on Construction Methods and Construction Periods

(1) Policies on construction methods

For Gogecha Bridge, the two bridge abutments and bank protections shall be constructed in the river. For Modjo Bridge, the concrete foundation of bridge piers shall be constructed close to the river. Since both the rivers were observed to have rapid water level increase, due attention must be paid to the work during the rainy season.

(2) Policies on Construction Periods

As described above, the conditions differ between sites. Therefore, appropriate construction periods shall be determined to carry out construction in safety in comprehensive consideration of the Ethiopian natural environment with a distinct rainy season, work type, overall flow of construction, etc.