

**Addis Ababa City Roads Authority  
The Federal Democratic Republic of Ethiopia**

**THE PREPARATORY SURVEY REPORT  
FOR  
THE PROJECT FOR UPGRADING ROAD  
MAINTENANCE EQUIPMENT  
IN ADDIS ABABA CITY  
IN  
THE FEDERAL DEMOCRATIC REPUBLIC  
OF ETHIOPIA**

**November 2019**

**JAPAN INTERNATIONAL COOPERATION AGENCY  
(JICA)**

**YACHIYO ENGINEERING CO., LTD.**

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## **PREFACE**

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Yachiyo Engineering Co., Ltd.

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

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

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

November, 2019

Hajime ADACHI  
Director General,  
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# SUMMARY

## ① Country Overview

The Federal Democratic Republic of Ethiopia (hereinafter referred to as Ethiopia) is a regional power located in the center of the “Horn of Africa”. It has an area of 1,097,000 km<sup>2</sup> (approx. three times the area of Japan) with a population of 110 million (2019, UNFPA). The GDP growth rate in 2017 was 10.86%, which was high in spite of internal conflicts, political unrest and measures taken to stabilize the fiscal deficit. The GDP growth rate in 2018 was predicted to be 8.5%. The GDP growth is supported by the development of energy, transport infrastructure, and industrial parks. High growth rates are particularly seen in the services sector (8.8% growth rate) and the industrial sector (12.2% growth rate). In addition, infrastructure construction through public investment and private investment triggered by strong and direct investment from foreign countries are driving the GDP growth. Furthermore, political reforms, including the normalization of diplomatic relations with Eritrea in July 2018, democratization, and the strengthening of justice system are also expected to contribute to the stabilization of the country's economy.

Despite steady economic growth of the country, the gap between the rich and the poor in the capital and rural areas has been remarkable, and population influx into Addis Ababa City is accelerating. In the city, traffic congestion and poor road condition have become serious issues due to the rapid progress of urbanization and motorization.

## ② Background and Outline of the Project

More than 95% of freight and passenger transport of Ethiopia is based on the road, which is considered the main infrastructure of the country. The infrastructure has improved remarkably, and the road length increased by 137% in the last 15 years after the road sector development program launched in 1997. However, the traffic demand has been increasing. Under these circumstances, the government of Ethiopia highlighted this in the national development plan “Growth and Transformation Plan II” (hereinafter referred to as GTPII), underlines the importance of high quality infrastructure to cope with rapid urbanization and also the importance of strengthening organizational structure for ensuring infrastructure sustainability, and the government is now working on relevant measures.

Addis Ababa City, which has been driving the robust economic growth (7~8% of GDP) of the country in recent years, is rapidly urbanizing, and many new roads are being developed. Addis Ababa City Roads Authority (hereinafter referred to as AACRA) is in charge of the maintenance of roads in Addis Ababa City and maintenance and management of the equipment. However, equipment shortages and deterioration of the equipment have led to the deterioration of the roads, making difficult to maintain good road conditions in the long term. To address these issues, the Government of Ethiopia is promoting capacity development based on the GTPII for regular inspection, data management, and formulation of maintenance management plan. Addis Ababa City has formulated a long-term development plan, "Addis Ababa City Structure Plan", and it is promoting the construction and maintenance of city roads. However, the city could not get on with the maintenance works due to deterioration and shortage of equipment.

It is under this circumstance that the Government of Ethiopia issued an official request for grant aid for road maintenance equipment to Japan in June 2015.

In response to the request, the Japan International Cooperation Agency (hereinafter referred to as JICA) conducted the preparatory survey for the grant aid.

### ③ Overview of Survey Result and project Contents

JICA dispatched a study team to Ethiopia from March 13 to April 8, 2019, as the phase-1 field survey. They confirmed the equipment requests and conducted field survey on the site where the Ethiopian executing agency, AACRA, will perform the road improvement works in the country with its own budget. After returning to Japan, the team conducted analysis based on the field survey results, completed outline design and estimated the project cost. It conducted the survey to explain the outline design from August 23 to September 1, 2019, based on the result.

The equipment to be procured in the Project is that necessary for the AACRA to carry out maintenance work on the targeted roads in Addis Ababa City (See the Location Map at the beginning) and equipment maintenance.

Soft Component is also provided as part of supporting efficient equipment operation and maintenance. It includes activities aimed to improve the equipment management system and strengthen the equipment maintenance and private sector utilization capacity.

Table 1 provides a list of equipment to be procured in the Project.



Table 1 Procured Equipment

No.	Equipment	Quantity
<b>(1) Road Maintenance Equipment</b>		
1	Wheel Loader	3
2	Backhoe Loader	7
3	Excavator	5
4	Road Stabilizer	1
5	Sheep Foot Compactor	5
6	Vibratory Tandem Roller	5
7	Tire Roller	3
8	Water Truck	3
9	Dump Truck	10
10	Cab-back Crane (3t)	2
11	Cab-back Crane (8t)	1
12	Aerial Work Platform Vehicle	4
13	High-pressure Drainage Cleaning Vehicle	3
14	Vacuum Tank Truck	3
15	Bitumen Distributor	3
16	Asphalt Burner	5
17	Asphalt Cutter	5
18	Asphalt Crack Sealer	5
19	Air Compressor	4
20	Air Breaker	5
21	Asphalt Mixer	3
22	Asphalt Plant	1
23	Mobile Workshop	1
<b>(2) Workshop Equipment</b>		
24	Container Workshop	1
25	Tire Changer	2
26	Portable Gantry Crane	2
27	Wheel Dolly	2
28	High Pressure Washer	5
29	Engine Hot Water High Pressure Washer	1
30	Engine Driven Welding Generator	2
31	AC Arc Welder	4
32	Portable Motor Driven Air Compressor	2
33	Parts Washing Stand	3
34	Jacks	2
35	Desktop Computer	1
36	Database Software	1

Source: Prepared by the Survey Team

#### ④ Project Schedule and Estimated Project Cost

The Project requires 22.5 months including bidding and procurement supervision starting from implementation design based on the Guidelines for Japan's Grant Aid Project

Table 2 Estimated Project Cost

Breakdown	Estimated Project Cost	Note
Japan side	-	
Ethiopian side	11,00,000 yen 99,000 USD	Preparation for the delivery of equipment, cost for operation and maintenance training for the Road Stabilizer and bank commissions

Exchange rate: 1USD=111.21 Japanese Yen

Source: Prepared by the Survey Team

#### ⑤ Project Evaluation

Relevance and effectiveness of the Project are summarized below.

##### (1) Relevance

Japan has established the following key assistance areas for Ethiopia to promote stability and development, and contribute to stable development of international economy including East Africa and Japan.

- ① Agricultural and rural development
- ② Industry promotion
- ③ Infrastructure development
- ④ Education and insurance

The Project belongs to the third (infrastructure development) of the four focus areas listed above, and the Project is deemed to align with Japan's policy for assistance to Ethiopia. In addition, it will contribute to the development of high-quality human resources in the field of infrastructure development through the promotion of road maintenance and technical guidance for equipment operation and maintenance through the Soft Component of the Project.

Addis Ababa road traffic is concentrated on the main roads or the streets whose pavement condition is relatively good. This has led to the deterioration of pavement condition, and chronic traffic congestion. Such deterioration of the city's traffic condition could hinder the growth of not only the economy of Addis Ababa, but also that of Ethiopia. Besides, such deterioration of the traffic condition may reduce the accessibility of the citizens to social services such as medical care and education. In recent years, this issue has been considered as a serious problem that could undermine the social stability of Addis Ababa City, which is rapidly urbanizing.

Therefore, in order to contribute to the stable and sustainable growth of the economy of Ethiopia and improve the living standard of citizens of Addis Ababa, the road maintenance capacity of AACRA has to be urgently improved.

As such, improvement and maintenance of the target roads is urgent and prioritized by the Government of Ethiopia, and hence it is concluded that the Project is relevant.

(2) Effectiveness

Expected quantitative effects of the road improvement works in the Project are summarized in Table 3.

Table 3 Quantitative Effects of Road Improvement

Indicator		Target	Current (2019) Level	Target Year (2024) Level
Indicator -1	Annual Road Maintenance Length	Addis Ababa City Roads Total length of the targeted road: 2,151 km	113km per year	140km per year
Indicator -2	Equipment Operation Rate	Road Maintenance Equipment	79%	88%

Source: Prepared by the Survey Team

Out of the two indicators shown in the table above, Indicator-1, “Annual Road Maintenance Length”, is set based on the maintenance records and visual observations recorded by AACRA. Indicator-2, “Equipment Operation Rate”, is set based on the equipment operation records of AACRA.

In addition to the quantitative effects listed above, various qualitative effects, including improvement of road safety, increase in passenger and freight transportation efficiency, improvement of accessibility to social services (schools, medical facilities, etc.), and improvement of sanitary environment are also expected. These are in line with the policies of targets 3.6 “By 2020, halve the number of global deaths and injuries from road traffic accidents” and 3.8 “Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all” in the Sustainable Development Goals (hereinafter referred to as SDGs).

Judging from the analysis presented in this Project Evaluation, it is concluded that this Project is relevant and is expected to be effective.

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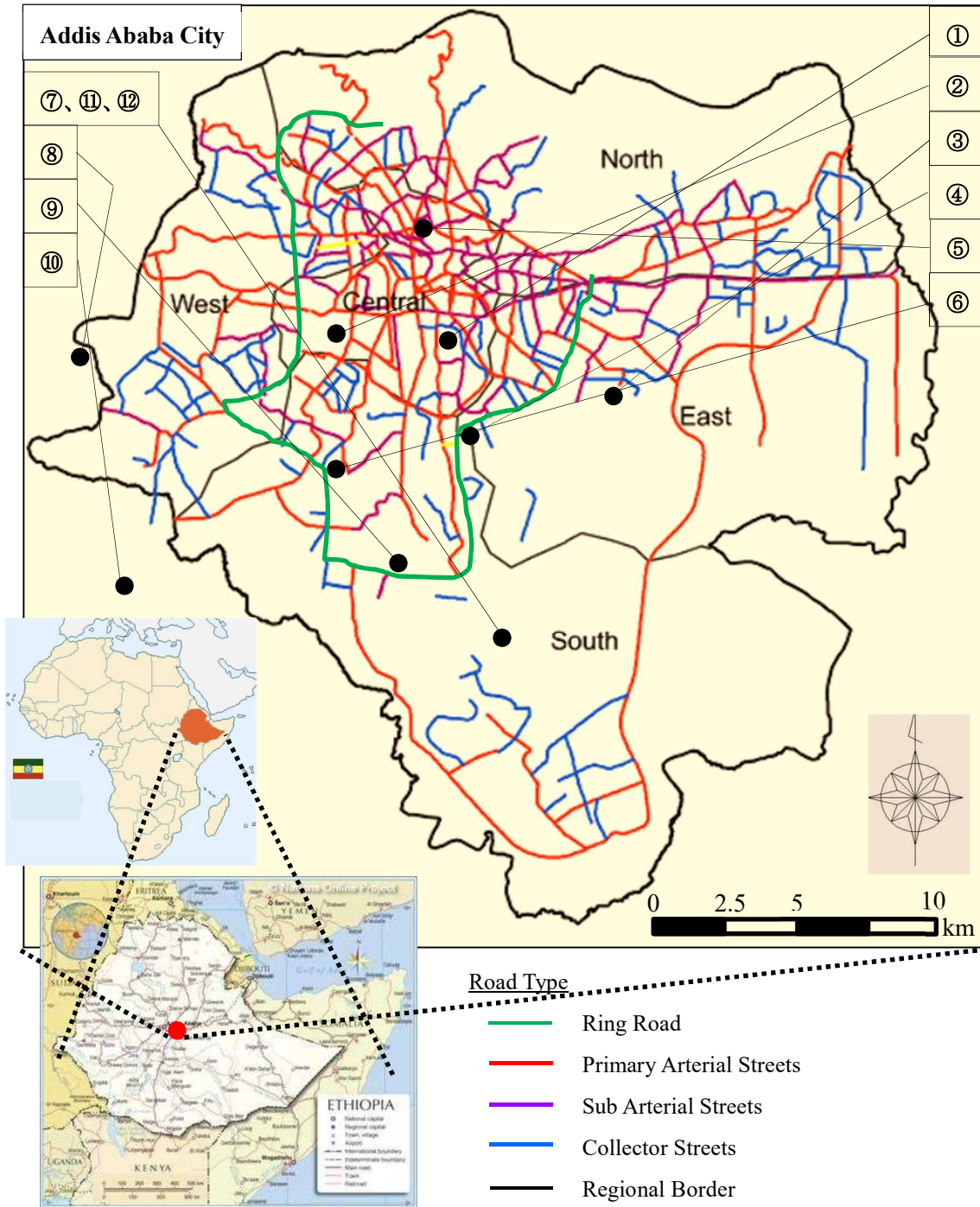
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## ABBREVIATIONS

AACRA	Addis Ababa City Road Authority
AARTB	Addis Ababa City Road and Transport Bureau
AFB	French Development Agency
AFDB	African Development Bank
ATTC	Alemgena Training and Testing Center
AU	African Union
BRT	Bus Rapid Transit
CSE	Centre for Science and Environment
ERA	Ethiopian Road Authority
ETB	Ethiopian Birr
GDP	Gross Domestic Product
GTPI	Growth and Transformation Plan I
GTPII	Growth and Transformation Plan II
ICT	Information Communication Technology
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
LRT	Light Rail Transit
MOT	Ministry of Trade
NMT	Non-Motorized Transport
OJT	On-The-Job Training
UN	United Nations
UNECA	United Nations Economic Commission for Africa
USD	United States Dollar

## **CHAPTER 1**

### **BACKGROUND OF THE PROJECT**

# Chapter 1 Background of the Project

## 1-1 Current Conditions and Issues of the Sector

### 1-1-1 Current Conditions and Issues

Addis Ababa, the capital city of the Federal Democratic Republic of Ethiopia (hereinafter referred to as Ethiopia), has a total road network of approx. 3,761 km, of which only 26.3% (about 990 km) are paved. The asphalt pavement ratio varies by road type, and the arterial roads (Ring Road, Primary Arterial Streets, and Sub Arterial Streets) have high ratio of 95.7% in average, while the others (Collector Streets and Local Streets) have low ratio of 15.9%. Although Addis Ababa City Roads Authority (hereinafter referred to as AACRA), which is responsible for road management of Addis Ababa City, could increase the road occupancy ratio from 13.5% (approx. 5,199 ha) in 2016 to 18% by March 2019, it is still below the 25% generally recommended for urban area. For this reason, the traffic of the city is concentrated on the arterial roads or the streets whose pavement condition is relatively good, leading to the deterioration and damage of the pavement. Such deterioration of the city's traffic condition could hinder the growth of not only the economy of Addis Ababa City, but also that of Ethiopia. Besides, such deterioration of the city's traffic condition reduces the accessibility of the citizens to social services such as medical care and education. In recent years, this issue has been taken as a serious problem that undermines the social stability of Addis Ababa City, which is rapidly urbanizing.

In order to improve the problems mentioned above, AACRA is promoting the construction of city roads and maintenance of the existing roads by annual budgets. However, many of the AACRA's road maintenance machineries have become inoperable due to breakdown or have declined work capacity due to aging exceeding service life. As a result, shortage of road maintenance equipment is causing significant delay of maintenance works.

Therefore, in order to contribute to the stable and sustainable growth of the economy of Ethiopia and improve the living standard of citizens of Addis Ababa City, the road maintenance capacity of AACRA has to be urgently improved.

Table 1-1.1 shows the total length of roads under the jurisdiction of AACRA by pavement type.

Table 1-1.1 Total Road Length under Jurisdiction of AACRA by Pavement Type  
(as of March 2019)

Pavement type	Road length (km)	Road length equivalent to 7 m-wide (km)	Ratio
Asphalt	990	181	26.3%
Cobblestone	1,846	1,117	49.1%
Gravel	386	415	10.3%
Stone Paved	278	438	7.4%
Earth	261	3,302	6.9%
Total	3,761	5,453	100.0%

Source: AACRA

Tables 1-1.2 and 1-1.3, respectively, show the total road length under the jurisdiction of AACRA by road type and by district.

Table 1-1.2 Total Road Length under Jurisdiction of AACRA  
by Road Type and Pavement Ratio (as of March 2019)

Road type	Total length (km)	Length with asphalt pavement (km)	Pavement ratio
Ring Road	37.0	37.0	100.0%
Primary Arterial Streets	290.0	279.3	96.3%
Sub Arterial Streets	164.0	153.8	93.8%
Collector Streets	215.0	135.8	63.0%
Local Streets	3,055.0	384.5	12.6%
Total	3,761.0	990.0	26.3%

Source: AACRA

Table 1-1.3 Total Road Length under Jurisdiction of AACRA  
by District and Pavement Ratio (as of March 2019)

Region		Total length (km)	Length with asphalt pavement (km)	Pavement ratio
Regional division <sup>※</sup>	Name			
East district	Bole	731.0	240.8	32.9%
West district	Kolfe kerenyio, Addis Ketama	811.0	164.8	20.3%
North district	Yeka, Gulele	844.4	178.5	21.1%
South district	Nefas-Silk Lafto, Akaki Kaliti	972.8	197.6	20.3%
Central district	Lideta, Kirkos, Arada	401.8	208.3	51.8%
Total		3,761.0	990.0	26.3%

Note) The regional division was set independently by AACRA as a maintenance jurisdiction area.

Source: AACRA

As shown in Table 1-1.3, the road pavement ratio is more than 50% in the central district which has heavy traffic flow into the city center and has the highest need for road maintenance. It is more than 30% in the east district, but it is only about 20% in other districts. Therefore, the variation of the pavement level among the regions is an issue.

In addition, means of a public transportation in Addis Ababa City, the Light Rail Transit (hereinafter

referred to as LRT) constructed by a Chinese company with a Chinese investment has been operated for approx. 31km. In the road section, running parallel to the LRT, traffic disruption and deterioration of the drainage function due to the LRT are problems.

### **1-1-2 Development Plans**

The Government of Ethiopia formulated the Growth and Transformation Plan II (hereinafter referred to as GTPII) targeting the years from 2015/16 to 2019/20 after the previous plan, Growth and Transformation Plan I (hereinafter referred to as GTPI). GTPI contributed the GDP growth of 10.2% and productivity improvement of 6.6% in agriculture, 20.0% in industry, and 10.7% in service industry, and sufficiently effected on development of economic base and capacity building. The GTPII target is to elevate Ethiopia to a middle-income country by 2025, and it is implemented with the following pillar strategies:

- Achieve an annual average real GDP growth rate of 11 percent within a stable macroeconomic environment;
- Develop the domestic engineering and fabrication capacity and improve productivity, quality, and competitiveness of the domestic productive sectors (agriculture and manufacturing industries) to speed up structural transformation;
- Further solidify the on-going public mobilization and organized participation to ensure the public become both owners and beneficiaries from development outcomes;
- Deepen the hegemony of developmental political economy by strengthening a stable democratic developmental state.

As a long-term development plan of Addis Ababa City, “Addis Ababa City Structure Plan” was formulated targeting the ten years from 2017 to 2027 with the following four pillars of development:

- Increase road density from the existing 13% to 25%;
- Provide comfortable road infrastructure and related facilities to the elderly, children, persons with disability, cyclists and pedestrians;
- Dedicate 50-60% of the street area at centers located inside the existing ring road and identified sections along transit oriented development corridors for non-motorized transport (bicycle lanes);
- Provide a hierarchically organized street network with the necessary infrastructure.

The above long-term development plan is used as a basis for developing new roads, and not for road maintenance. However, AACRA wants to develop a long-term road maintenance plan, and the maintenance is expected to be carried in a planned way.

AACRA is undertaking the promotion and strengthening of its road maintenance system against this backdrop, and the roads targeted by the Project are consistent with the maintenance plan of the Addis Ababa City.

### 1-1-3 Social and Economic Conditions (Political and Socio-Economic Conditions)

#### (1) General Condition of Ethiopia and Addis Ababa City

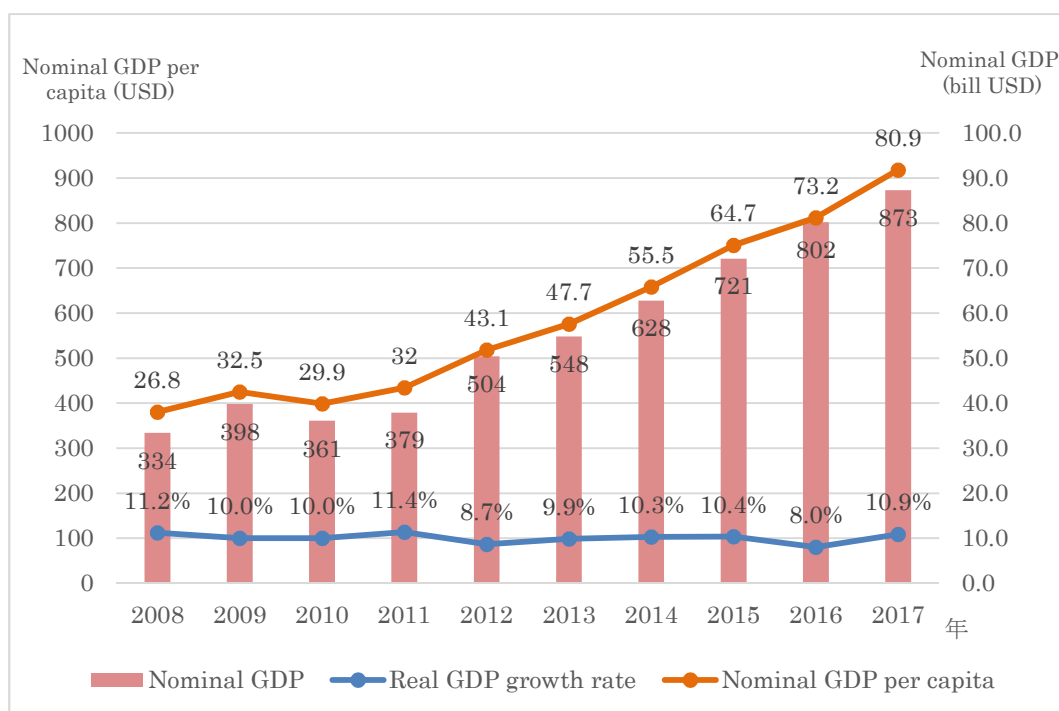
Ethiopia has an area of 1,097,000 km<sup>2</sup> (approx. 3 times the area of Japan) with a population of 110 million (2019, UNFPA).

Table 1-1.4 provides basic social indicators of the country.

Table 1-1.4 Basic Social Indicators

Indicator	Value	Unit	Source
National land	1,097,000	km <sup>2</sup>	2014, World Bank
Population	110,000,000	person	2019, UNFPA
Urban population ratio	20.3	%	2017, World Bank, United Nation
Poverty ratio (living with under 1.9 \$ per day)	26.7	%	2015, World Bank
Literacy rate (aged over 15 years old)	49.0	%	2015, World Bank
Primary school (1 <sup>st</sup> Cycle) enrollment ratio	95.5	%	2012, Ministry of Education
Secondary school (2 <sup>nd</sup> Cycle) enrollment ratio	47	%	2012, Ministry of Education
Unemployment rate	5.3	%	2018, World Bank

Figure 1-1.1 shows the trend of the GDP. The GDP growth rate in 2017 was 10.86%, which was high in spite of internal conflicts, political unrest and measures taken to stabilize the fiscal deficit. The GDP growth rate in 2018 was predicted to be 8.5%. The GDP growth is supported by the development of energy, transport infrastructure, and industrial parks. High growth rates are particularly seen in the services sector (8.8% growth rate) and the industrial sector (12.2% growth rate). In addition, infrastructure construction through public investment and private investment triggered by strong and direct investment from foreign countries are driving the GDP growth. Furthermore, political reforms, including the normalization of diplomatic relations with Eritrea in July 2018, democratization, and the strengthening of justice system are also expected to contribute to the stabilization of the country's economy.



Source: International Monetary Fund, World Economic Outlook Database 2018

Figure 1-1.1 GDP Trend

Table 1-1.5 provides the ratio of GDP by industry.

Table 1-1.5 GDP Ratio by Industry

Industrial Classification		2009	2014
Primary Industry	Agriculture, forestry, fisheries and hunting	<b>47%</b>	<b>39%</b>
Secondary Industry	Mining	1%	1%
	Manufacturing	4%	5%
	Electricity, gas and water	1%	1%
	Construction	4%	9%
	Total of secondary industry	<b>10%</b>	<b>15%</b>
Tertiary Industry	Wholesale, retail, hotel and restaurant	19%	22%
	Transportation, warehousing and telecommunications	5%	5%
	Finance and real estate	12%	10%
	Public services	3%	5%
	Other services	5%	5%
	Total of tertiary industry	<b>44%</b>	<b>47%</b>
Total		100	100%

Source: UNECA "African Economic Outlook 2016"

Table 1-1.6 shows the national fiscal revenues and expenditures. The fiscal deficit still continues although it decreased in 2017 compared to 2016 in response to the economic growth. Along with this, the government's dependence on foreign aid is still high.

Table 1-1.6 Fiscal Revenues and Expenditures of Ethiopia

(Unit: million ETB)

Items	2016	2017
Revenues and donations	269,105.9	338,280.0
Tax revenues	210,135.9	266,609.4
Direct tax	81,410.4	101,768.6
Indirect and other taxes	128,725.4	164,840.7
- Indirect tax	62,523.1	78,503.1
- Other taxes	66,202.4	86,337.7
Non-tax revenues	46,493.2	54,493.9
Donations	17,176.7	12,476.9
Annual Expenditures	329,286.8	354,205.3
Current expenditures	176,703.0	210,470.2
General services	53,697.4	62,715.7
Financial services	23,536.3	26,503.3
Social services	86,659.4	97,845.8
Interest rate payment	8,248.1	11,570.7
Others	4,561.9	11,834.9
Investment	152,583.8	143,735.1
Economic development	98,781.3	89,717.1
Social development	39,869.0	37,477.1
General development	13,933.6	16,540.9
Fiscal Revenues and Expenditures (including donations)	-60,180.9	-15,925.3

Source: National Bank of Ethiopia, 2019

Note) 1 ETB = 0.035 USD

The population of Addis Ababa City, which is the target area of the Project and the political and commercial center of the country, was approximately 2.7 million in 2007 (according to the latest 2007 census) and it is estimated to increase to 4 million by 2019. The city has an area of 527 km<sup>2</sup> and a population density of 5,165 people per km<sup>2</sup>.

Despite steady economic growth of the country, the gap between the rich and the poor in the capital and rural areas has been remarkable, and population influx into Addis Ababa City is accelerating. In the city, traffic congestion and poor road condition have become serious issues due to the rapid progress of urbanization and motorization. Many development projects have been carried out by Chinese funds, including the building of the African Union headquarters and the stadium under construction.

## (2) Politics and Administration

Addis Ababa City, which is a seat of the African Union (AU) and the United Nations Economic Commission for Africa (UNECA) and one of the African political and diplomatic centers, and Dire Dawa City are treated as special administrative districts, and there are nine other regional states.

Ethiopia is a federal republic under the constitution enacted in 1994 with a prime minister and president. Ethiopian parliament consists of two houses: the House of Federation (110 members), and the House of People's Representative (547 members). The prime minister is appointed by the ruling party, and is the most powerful figure of the country. The cabinet consisting of ministries was restructured in 2018, and it currently consists of twenty ministries. The cabinet ministers are appointed



by the prime minister and approved by the House of People’s Representatives. The president, whose role is largely ceremonial, is also elected by the House of People’s Representatives.

Ethiopia is the first African federal country to adopt an administrative division based on language and ethnicity. About half of the residents of Addis Ababa City are Amhara, followed by Oromo. Addis Ababa City is administrated by a mayor and city council, but it is also subject to the federal laws and regulations since it is a special administrative district. City councilors are elected by the residents, and the city council elects the mayor among the councilors. However, in the event of a government crisis, the mayor may be appointed by the federal government. Addis Ababa City is further divided into 10 administrative districts, and each has its own council.



	District	Area (km <sup>2</sup> )	Population (person)	Density (person/km <sup>2</sup> )
1	Addis Ketama	7.41	271,644	36,659
2	Akaki Kaliti	118.08	195,273	1,654
3	Arada	9.91	225,999	23,000
4	Bole	122.08	328,900	2,694
5	Gulele	30.18	284,865	9,439
6	Kirkos	14.62	235,441	16,104
7	Kolfe Kernyo	61.25	546,219	7,449
8	Lideta	9.18	214,769	23,000
9	Nefas-Silk Lafto	68.30	335,740	4,916
10	Yeka	85.46	337,575	3950

Source: City Government of Addis Ababa

Figure 1-1.2 Administrative Districts in Addis Ababa City

### (3) Health and Medical Care

Table 1-1.7 shows basic indicators about condition of health and medical service in Ethiopia or Addis Ababa City.

Table 1-1.7 Indicators about Condition of Health and Medical Service

Indicator	Value	Unit	Source
Infant mortality rate (under 5 years old)	41	person per 1,000	2017, World Bank
Number of beds	0.3	number per 1,000	2015, WHO
Number of doctors	0.025	person per 1,000	2010, WHO
Number of nurses	0.236	person per 1,000	2010, WHO
Unemployment rate	5.3	%	2018, World Bank
Water supply coverage rate	52	%	2012, WHO/UNICEF
Sewerage coverage rate (Addis Ababa City)	7.3	%	2014, Waterworks and Sewerage Bureau

There were 12 state hospitals and more than 40 private hospitals in the Addis Ababa City in 2014. Many state hospitals are over 30 years old, while many of the private hospitals have been established in the past 21 years.

In Addis Ababa City, the water supply coverage rate is 71%, but only 7.3% of the population has

sewerage connection. The city's Water and Sewerage Department is in charge of the operation and management of sewage disposal facilities and sanitary facilities. There are three dams in the city for water supply facilities. The dams distribute water to purification plants at their downstream. The shortfall of water supply is supplemented by wells. There are two sewage disposal plants in the city, where both the sewage coming from the sewer and the dirt drawn by the vacuum trucks are treated. However, the sewage treatment rate by these plants is about 45%, and many places drain the waste water into rivers, swamps, and lakes. In addition, the Waterworks and Sewerage Bureau operates and manages about 60 public toilets in the city.

#### **(4) Education**

There are 19 elementary and junior high schools, 14 high schools, and 9 universities or colleges (both public and private) in Addis Ababa City. There are also many research institutes, medical centers and private schools.

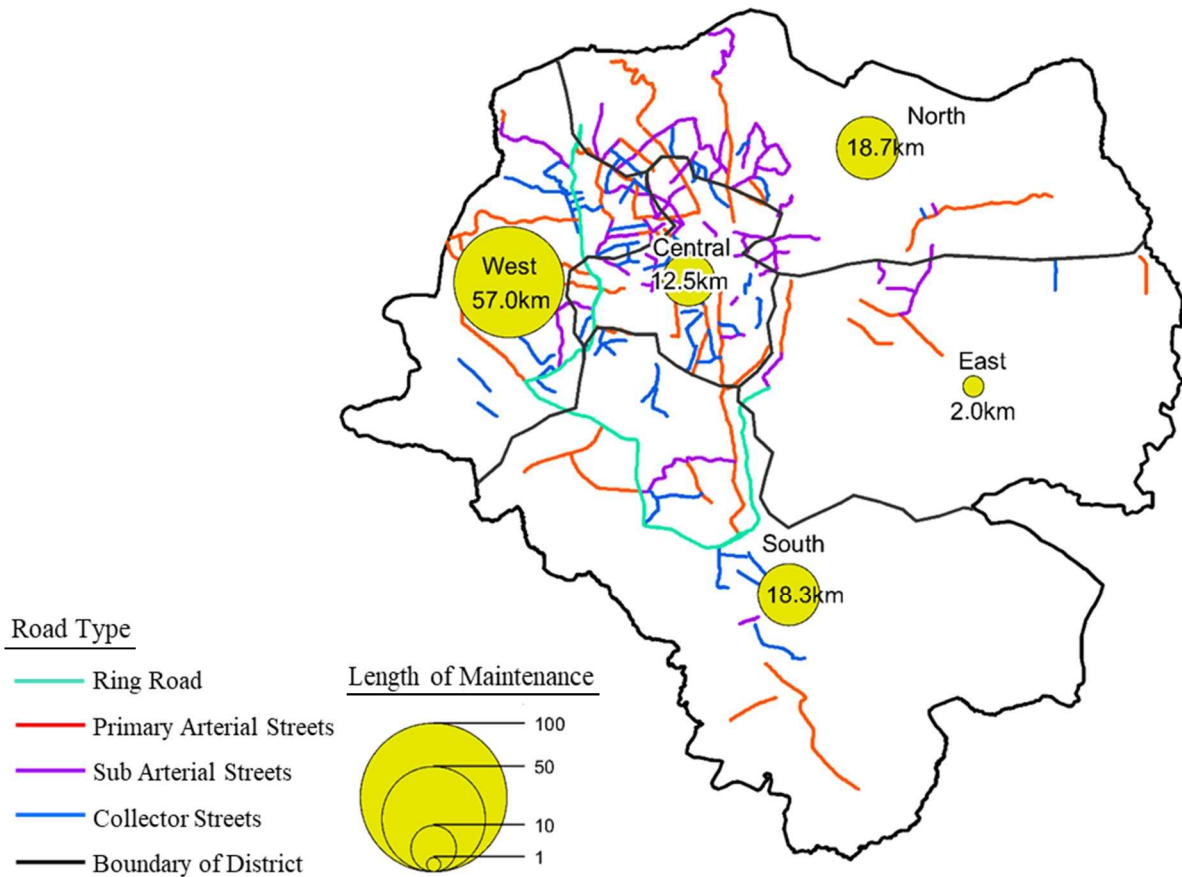
#### **(5) Power supply**

The urban electrification rate of Ethiopia was 85% in 2011. According to the Addis Ababa Distribution Master Plan (AADMP), the city's power demand is expected to increase from 800 MW (2014) to 3,600 MW (2034) due to the remarkable population growth and economic development.

### **1-2 Conditions of Project Site and Surrounding Areas**

#### **1-2-1 Current Conditions of Related Infrastructure**

Figure 1-2.1 shows the results of road maintenance by AACRA in 2018. Each line on the map shows the road type for which road maintenance was implemented, and the figures in parenthesis show the total length by district. The target roads vary widely in the city, both by road type and area. After acquiring the Project equipment, AACRA will set up a target section of roads for each fiscal year according to the degree of damage, and then promote road maintenance in a balanced way.



Note) The line on the map indicates the roads targeted by the maintenance, and maintenance may be planned for a part and not necessarily the whole section of the road

Source: Prepared by the Survey Team based on the data from AACRA

Figure 1-2.1 Results of Road Maintenance by AACRA in 2018

Over 90% of the Ring Road, Primary Arterial Streets, and Sub Arterial Streets of Addis Ababa are paved with asphalt. However, with the recent increase of traffic volume, the roads have some cracks and potholes. Damaged road with heavy traffic is dangerous because it causes traffic jams and accidents, so periodical maintenance is required. As the current situation of material procurement for road maintenance, many of materials used for the road maintenance such as bituminous mixture, concrete, and macadam are procured from local suppliers. The prices of these materials are high because there are few suppliers who own plants and price competition has not occurred.

In addition, there are many places along the roads where drain ditch and catch basin are not working well because they are blocked by waste and sludge. Although AACRA cleans them two to four times a year, it is difficult to clean them because some of the lids of catch basin are covered and cannot be removed. As a result, road inundation occurs when it rains, about 7 or 8 times a year, which make the road impassable and affect citizens' lives.

The current condition of road maintenance by AACRA of each road type is described below.

### (1) Ring Road

Ring Road is a road that links the entire city in a ring form. Its asphalt pavement ratio is 100%. Its total length as of 2019 is 37km. A part of the northern to eastern part has not been constructed,

however, Addis Ababa City Structure Plan 2025 targets its completion. Addis Ababa City has an elevation difference of about 300 m, so it has a downward slope from the north to the south. In addition, although there are many viaducts in the western and eastern parts of the city, many other sections in the northern and southern area don't have viaducts and run parallel to the Primary Arterial Streets.

It has many steep sections because of the difference of elevation, but vehicles can drive at about 70 km/hour in the section which is not congested. The road surface condition in low traffic sections is good, but damage such as cracks appears at intersections with the Primary Arterial Streets and sections running parallel to them.

The pavement structure in the Ring Road consists of four layers of subbase course 30 cm, base course 15cm, binder course 6cm, and surface course 4cm.

## **(2) Primary Arterial Streets**

Primary Arterial Streets are the second highest grade streets in the AACRA road hierarchy following the Ring Road. Their standard width is 30 m to 60 m, and their total length is 290 km. They extend radially from the city center and cross the Ring Road to access the suburbs. LRT developed by China is located in the middle of such roads. As well as the Ring Road, the Primary Arterial Streets have very steep sections due to the difference of elevation of Addis Ababa City. In particular, National Road No.3, which is developed by Japanese companies and extends from the city center to the north, is very steep.

About 96% of the Primary Arterial Streets are basically paved with asphalt. The pavement structure in the Primary Arterial Streets consists of four layers of subbase course 30 cm, base course 15cm, binder course 6cm, and surface course 4cm. Unlike the Ring Road, Primary Arterial Streets have heavy traffic throughout the city. They are also used by a lot of heavy vehicles loaded with supplies including those from Djibouti, so potholes and cracks can be seen. Therefore some of the roads have been maintained several times by placing 10 cm overlay. As a result, the road surface is raised to the curbstone level or above it.

Poor drainage and traffic performance of the roads divided by the LRT, which is constructed by Chinese company with a foundation by Chinese government, are particularly regarded as main problems of the roads running along the LRT. Most part of this LRT is built on the ground level, and extends up to 2 km without crossing points. Therefore, it completely divides the flow of traffic. In addition, during the construction of LRT, some of the existing drainage facilities were removed or relocated. As a result, drainage failure occurs along the LRT when it rains.

## **(3) Sub Arterial Streets**

Sub Arterial Streets are especially located in the city center area, and are developed to connect each Primary Arterial Street. Their standard width is 20 to 25 m. They are relatively shorter than Ring Road and Primary Arterial Streets, and the longitudinal slope is gentle. Their total length is 164 km, which is the shortest above the road types except Ring Road.

Approx. 94% of the Sub Arterial Streets are basically paved with asphalt. The pavement structure in the Sub Arterial Streets consists of four layers of subbase course 30 cm, base course 15cm, binder

course 6cm, and surface course 4cm, which is the same as the two road types mentioned above. The road surface condition is relatively bad in many places, and there are many potholes and cracks especially in the city center where traffic is heavy. As well as the Primary Arterial Streets, the streets are overlaid several times and the road surface is raised to curbstone level or above it. In addition, traffic congestion is particularly severe on these roads in city center area; therefore it is common to drive at as low as 15 km /hour in these area.

#### **(4) Collector Streets**

Collector Streets connect the above three types of roads and the Local Streets. Their total length is 215 km. There are a lot of houses and commercial buildings along Collector Streets; therefore, there are some sections which are as narrow as 10 m and do not meet the standard width specified by AACRA (15 m). Although these roads are the second lowest grade in the AACRA road hierarchy following the Local Streets, their traffic volume is big due to the vehicles which flow in as a detour on the main road. In addition, it is difficult to run at a constant speed due to road damage. As a results, traffic congestion is caused by the stagnation of the following vehicles when large vehicles pass each other.

AACRA standard requires the Collector Streets be paved with asphalt. The pavement structure in the Collector Streets is consist of four layers of subbase course 30 cm, base course 15cm, binder course 6cm, and surface course 4cm, which is the same as the three road types mentioned above. However, there are some sections which are developed by only one layer of asphalt pavement. About 63% of the roads are paved with asphalt, and the remaining 37% are paved with cobblestone, macadam, stone or are earth roads. Basically, passenger cars can drive on Collector Streets, but four-wheel drive vehicle (4WD) is required on some of the earth roads.

In addition, constructions to underground drainage pipes of approx. 60 cm in diameter are underway for some of the Collector Streets; however, the excavated soil is left on the road further narrowing the road, and creating obstacles to the passing vehicles. Besides, excavation and crane works are carried out on a narrow roads, making the safety of pedestrians during the construction an issue.

#### **(5) Local Streets**

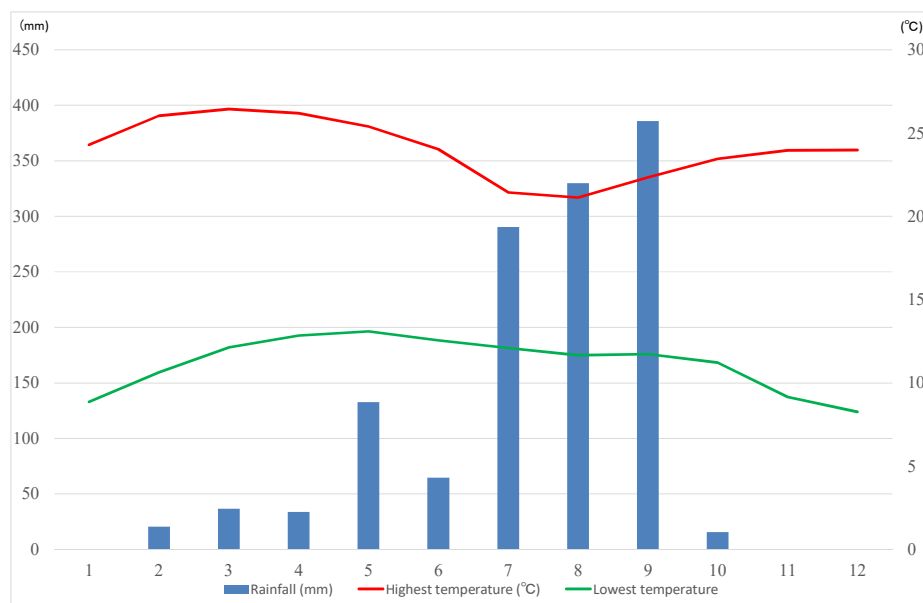
Local Streets are found at the lowest grade road in the AACRA road hierarchy. They run through the residential areas and villages throughout the city. Therefore their total length is 3,055 km, which is longer than other road types. Their standard width is 10 m. However, there are many roads with a width of only 5 m because the houses are lined up on both sides of these roads and it is practically difficult for vehicles to pass each other on the Local Streets.

Only 12.6% of the Local Streets are paved with asphalt, and most of the roads in the city center are paved with cobblestone while those in outskirts areas are earth roads. There are few places where vehicles cannot pass at all; however, drainage facilities such as side ditch are unsatisfactory, and the living condition is poor.

### 1-2-2 Natural Conditions

Ethiopia is an inland country surrounded by Somalia in the east, Kenya in the south, South Sudan in the west, Sudan in the northwest, Eritrea in the north, and Djibouti in the northeast. Its land area is approx. 1,100,000 km<sup>2</sup>. Addis Ababa, the capital city, is located in a plateau area in the central part of the country at latitude 8 degrees 55 minutes to 9 degrees 5 minutes north and longitude 38 degrees 40 minutes to 50 minutes east. The area of Addis Ababa City is 527 km<sup>2</sup>, and it is located in an area with an average slope of 1/30 and altitude of 2,300 to 2,600 m.

Addis Ababa's climate comprises dry season from October to June and rainy season from July to September. The maximum temperature fluctuates between 20°C and 30°C, and the lowest temperature ranges between 5 °C and 15 °C. The humidity is as high as 80% in April to September, and as low as 45% to 55% in October to March. Figure1-2.2 shows average monthly rainfall and temperature in Addis Ababa City from 2012 to 2018.



Source: Prepared by the Study Team based on data from National Meteorological Agency

Figure 1-2.2 Average Monthly Rainfall and Temperature in Addis Ababa (Average of 2012 to 2018)

In addition, the stratum is generally composed of soft rock containing sandy soil, although there are exposed rocks along roads and residential areas.

### 1-2-3 Environmental and Social Consideration

The Project is to procure the equipment, and no adverse effect on the environment is envisaged. The road maintenance works will be carried out in accordance with the laws of Ethiopia.

### **1-3 Background to and Outline of the Grant Aid**

More than 95% of freight and passenger transport of Ethiopia is based on the road, which is considered the main infrastructure of the country. The infrastructure has improved remarkably, and the road length increased by 137% in the last 15 years after the road sector development program launched in 1997. However, the traffic demand has been increasing. Under these circumstances, the government of Ethiopia highlighted this in the national development plan “Growth and Transformation Plan II” (hereinafter referred to as GTPII), underlines the importance of high quality infrastructure to cope with rapid urbanization and also the importance of strengthening organizational structure for ensuring infrastructure sustainability, and the government is now working on relevant measures.

Addis Ababa City, which has been driving the robust economic growth (7~8% of GDP) of the country in recent years, is rapidly urbanizing, and many new roads are being developed. Addis Ababa City Roads Authority (hereinafter referred to as AACRA) is in charge of the maintenance of roads in Addis Ababa City and maintenance and management of the equipment. However, equipment shortages and deterioration of the equipment have led to the deterioration of the roads, making difficult to maintain good road conditions in the long term. To address these issues, the Government of Ethiopia is promoting capacity development based on the GTPII for regular inspection, data management, and formulation of maintenance management plan. Addis Ababa City has formulated a long-term development plan, "Addis Ababa City Structure Plan", and it is promoting the construction and maintenance of city roads. However, the city could not get on with the maintenance works due to deterioration and shortage of equipment.

It is under this circumstance that the Government of Ethiopia issued an official request for grant aid for road maintenance equipment to Japan in June 2015.

In response to the request, the Japan International Cooperation Agency (hereinafter referred to as JICA) conducted the preparatory survey for the grant aid.

## **CHAPTER 2**

### **CONTENTS OF THE PROJECT**



## **Chapter 2 Contents of the Project**

### **2-1 Basic Concept of the Project**

#### **2-1-1 Superior Objective and Project Goals**

Recently in Ethiopia, GDP growth rate has continuously recorded 7 to 8%. Roads, on which more than 95% of freight and passenger transport is based, are the main infrastructure in Ethiopia. In Addis Ababa City, the capital city and has been driving the robust economic growth of the country, asphalt paved road is only approx. 26.3% (approx. 990km) of total road length (approx. 3,761km). Therefore, traffic is centralized in these roads and traffic congestion has become chronic, and as a result, deterioration and damage of existing asphalt pavements have become serious. Under such circumstances, the Government of Ethiopia aims to grow into a middle-income country by 2025, and established the national development plan “Growth and Transformation Plan II (GTPII)” to achieve the objective.

In Addis Ababa City, urbanization is progressing rapidly and the traffic demand is continuously increasing. Under such condition, new roads are being developed. AACRA is in charge of the maintenance of the city roads and various equipment. However, lack of equipment and difficulty of maintaining technical knowledge level have led to the deterioration of the road condition, making difficult to maintain good road conditions in the long term. To address these issues, the Government of Ethiopia is promoting capacity development based on the upper-level plan GTPII for regular inspection, data management, and formulation of maintenance management plan. In addition, Addis Ababa City has formulated a long-term development plan, "Addis Ababa City Structure Plan", as a lower-level plan of GTPII and it is promoting the construction and improvement of maintenance on the city roads aiming to promote road infrastructure considering vulnerable people and development of road network in the city. However, the city could not get on with the maintenance works due to deterioration and shortage of equipment.

The Project is positioned to realize the upper-level objective, GTPII. The Project is to procure road maintenance equipment for maintenance of primary streets (Ring Road, Primary Arterial Streets and Sub Arterial Streets) and their access roads, which are highly important for ensuring smooth traffic. The Project is also aimed to contribute to the effective use of road asset management by AACRA.

#### **2-1-2 Outline of the Project**

The Project is to procure road maintenance equipment and workshop equipment that AACRA needs to effectively conduct the maintenance works required for the improvement and maintenance of roads in Addis Ababa City (see the Locational Map at the beginning). The Project includes a soft component, which is described in detail in Section 2-2-4-8, “Soft Component Plan”, to assist AACRA in efficient equipment operation and maintenance in order to achieve the project objectives described above.

The list of the equipment planned to be procured by the Project is shown in Table 2-1.1.

Table 2-1.1 Amount of Equipment to be Procured

No.	Equipment	Quantity
(1) Road Maintenance Equipment		
1	Wheel Loader	3
2	Backhoe Loader	7
3	Excavator	5
4	Road Stabilizer	1
5	Sheep Foot Compactor	5
6	Vibratory Tandem Roller	5
7	Tire Roller	3
8	Water Truck	3
9	Dump Truck	10
10	Cab-back Crane (3t)	2
11	Cab-back Crane (8t)	1
12	Aerial Work Platform Vehicle	4
13	High-pressure Drainage Cleaning Vehicle	3
14	Vacuum Tank Truck	3
15	Bitumen Distributor	3
16	Asphalt Burner	5
17	Asphalt Cutter	5
18	Asphalt Crack Sealer	5
19	Air Compressor	4
20	Air Breaker	5
21	Asphalt Mixer	3
22	Asphalt Plant	1
23	Mobile Workshop	1
(2) Workshop Equipment		
24	Container Workshop	1
25	Tire Changer	2
26	Portable Gantry Crane	2
27	Wheel Dolly	2
28	Engine High Pressure Washer	5
29	Hot Water High Pressure Washer	1
30	Engine Driven Welding Generator	2
31	AC Arc Welder	4
32	Portable Motor Driven Air Compressor	2
33	Parts Washing Stand	3
34	Jacks	2
35	Desktop Computer	1
36	Database Software	1

Source: Prepared by the Survey Team

## 2-2 Outline Design of the Japanese Assistance

### 2-2-1 Design Policy

#### (1) Basic Policy

##### 1) Road Maintenance Equipment

Table 2-1.1 shows targeted road type of the Project and maintenance length by AACRA.

Table 2-2.1 Target Road Type of the Project and Maintenance Length by AACRA

Target Road Type	Maintenance Length	Maintenance Length equivalent to 7 m-wide road
Ring Road (RR)	37 km	181 km
Primary Arterial Streets (PAS)	290 km	1,117 km
Sub Arterial Streets (SAS)	164 km	415 km
Collector Streets (CS)	215 km	438 km
Total	706 km	2,151 km

Source: AACRA

The basic policy is to procure road maintenance equipment that AACRA needs to maintain the targeted road type shown in Table 2-2.1. At the targeted roads in the Project, existing asphalt pavement will be repaired with crack repair and pothole patching and some sections will be replaced with asphalt pavement.

The annual road maintenance length and expenditure in the past three years by AACRA is shown in Table 2-2.2. The road maintenance performance in 2018 increased with the increase in budget. AACRA is able to use rental equipment along with its own equipment. The reason is that AACRA made maintenance a priority policy and installed 5 maintenance bases. AACRA is proceeding with the same plan in 2019 and after 2020.

Table 2-2.2 Annual Road Maintenance of AACRA

	2015	2017	2018
Annual road maintenance (equivalent to 7 m wide road)	50.6km	59.9km	113.6km
Annual expenditure (1,000ETB)	172,190	203,964	386,827

Source: AACRA

Note) The 2016 data are excluded because of lacking in data.

Table 2-2.3 shows actual road maintenance cost in the first term of the fiscal year 2019 (September 2018 to February 2019) and estimated cost after the procurement of equipment, and also shows the reason of increase/decrease in each cost.

Table 2-2.3 Comparison of Actual Construction Cost of the First Term of Fiscal Year 2019 and Estimated Cost after the Procurement of Equipment

	Cost (1,000ETB)					Length (km)	Maintenance cost per 1 km (1,000ETB)
	Material cost	Labor cost	Equipment rental cost	Fuel cost and etc.	Total		
① Costs of the first term of fiscal year 2019 (September 2018 to February 2019)	84,956	41,965	13,557	4,933	145,411	42.7	3,405
② Estimated costs after procurement of equipment	63,523	46,161	0	7,399	117,083	42.7	2,742
Increase/decrease in costs	-21,433	+4,196	-13,557	+2,466	-28,328	-	-663
Reason of increase/decrease	Reduction of asphalt mixture purchase costs	Increase of AACRA's own expenses by new equipment	Change from rental equipment to procurement equipment	Increase of AACRA's own expenses by new equipment	-	-	-

Source: Prepared by the Survey Team based on the data from AACRA

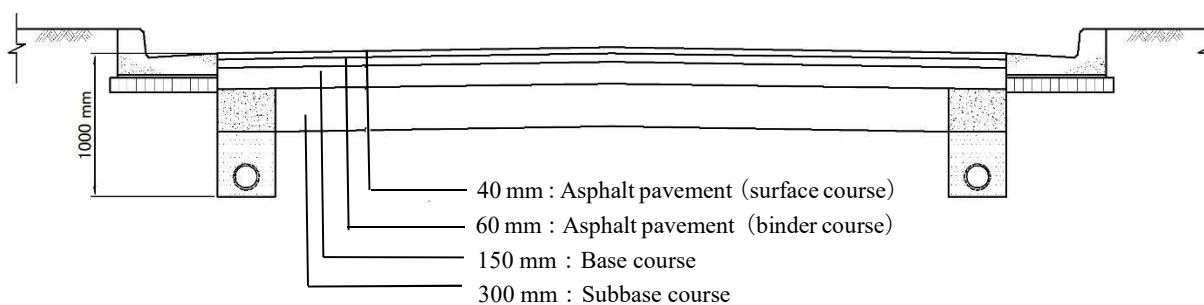
Road maintenance cost reduced by 663 thousand ETB to 2,742 thousand ETB. By extending this reduction amount of 663 thousand ETB to road maintenance, road maintenance length will be increased from 113km in 2018. The calculation procedure for road maintenance extension after equipment procurement is shown below.

- Increase of road maintenance length after procurement of equipment  
 Decrease of costs by procurement of equipment: 28,328 (1,000ETB) /42.7km  
 Maintenance cost per 1 km after procurement of equipment: 2,742 (1,000ETB) / km  
 Increase of road maintenance length after procurement of equipment: 28,328/2,742=10.3km
- The rate of increase of road maintenance length after procurement of equipment  
 The rate of increase calculation: (42.7+10.3) / 42.7=1.24 (24%)

From the above calculation, the annual maintenance length after the procurement is expected 24%.

Therefore, the planned road maintenance length after the procurement is 140km (annual road maintenance length 113km x 124%).

Figure 2-2.1 shows a typical cross-section of the target roads.



Source: AACRA

Figure 2-2.1 Typical Cross-Section of Target Roads

## 2) Workshop Equipment

Table 2-2.4 shows the number of the road maintenance equipment owned by AACRA and rate of equipment operation in 2019 (rate of equipment operation means average value in the case that assumed the operation of 200 days a year to be 100%). The basic policy is to procure workshop equipment that AACRA needs to secure 88% of the rate of road maintenance equipment operation shown in Table 2-2.5.

Table 2-2.4 The Number of the Road Maintenance Equipment Owned by AACRA and Rate of Equipment Operation in 2019

The targeted equipment	568 cars (except equipment are impossible to repair)
The rate of equipment operation	79%

Source: Prepared by the Survey Team

Table 2-2.5 shows the number of the road maintenance equipment owned by AACRA and rate of equipment operation after procurement.

Table 2-2.5 The Number of the Road Maintenance Equipment Owned by AACRA and Rate of Equipment Operation after Procurement

The targeted equipment	447 cars (①Equipment owned after 2005 production : 360 cars <sup>Note1</sup> ) + ② Road maintenance equipment by the Project : 87 cars)
The rate of equipment operation	①The rate of the operation of equipment owned after 2005 production : 86% (On the basis of 79% of rates of operation in 2019, It is shortened approx. 1/3 maintenance time <sup>Note2</sup> ) by the exclusion of equipment owned before 2005 production and efficiency by the procurement of workshop equipment by the Project. ②The rate of the operation of road maintenance equipment by the Project : 98% (periodical maintenance four days a year) The rate of the targeted equipment operation : 88% (from ① and ②)

Note 1) In the number of equipment owned by AACRA after the Project, old equipment manufactured before 2005 will exceed the service life of about 10 years or more and aging will become prominent in 2024 which is the target year of the project. Therefore, the old equipment was excluded.

Note 2) Shortened time is estimated with AACRA from ability for work and effectiveness of workshop equipment by the Project.

Source: Prepared by the Survey Team

## **(2) Policy Regarding Selection of Equipment**

In the selection of the equipment to be procured in the project, the actual situations of the project site, and the needs of AACRA to carry out road maintenance works of the target roads properly (see the Locational Map at the beginning) are considered.

In the composition of equipment, the types, specifications and quantities of equipment are determined in view of the conditions based on the following conditions:

- Geographical conditions, geological conditions and meteorological conditions of the target road areas
- Current conditions of the target roads
- Types, methods, scale and implementation schedule of road improvement
- Capacity to receive new equipment, including operation and maintenance setup (organization, personnel, facilities, equipment, budget)
- Contents and conditions of existing equipment
- Situations of landing places in connection with import of equipment, for example, current conditions of harbor facilities and equipment
- Conditions of inland transportation of equipment, for example, transport routes and weight limitations
- Current conditions and setup of local private operators involved in after-sale services following the handover of equipment.

## **(3) Policy Regarding Natural Environmental Conditions**

The climate in Addis Ababa City comprises dry season from October to June and rainy season from July to September. The maximum temperature fluctuates between 20°C and 30°C, and the lowest temperature changes between 5°C and 15°C. The humidity is as high as 80% from April to September, and as low as 45% to 55% from October to March. The annual rainfalls are around 1,300 millimeters, and in the wet season the rainfalls are 1,000 millimeters, which is around 75% of annual rainfalls. In consideration of such natural conditions, the target road maintenance works shall be planned for 9 months annually, excluding July, August, and September.

Since the elevation of the target area is 2,300 m to 2,600 m, incomplete combustion may occur due to an insufficient amount of air supplied to the engine, so there is a concern that the engine may not achieve the rated power output. Therefore, a specification suitable for high altitudes is required. Selection of a high-power engine and countermeasures such as turbo should be considered for the engine of each equipment to ensure sufficient work capacity.

## **(4) Policy Regarding Construction and Procurement Conditions**

### **1) Fuel Procurement Situation**

The sulfur content of light oil, which is a fuel of the equipment, is necessary for lubricating mechanical fuel injection devices used in diesel engines, however, the combusted sulfur produces sulfides, among other problems. Responding to the increasingly stringent exhaust gas controls of recent years, desulfurization catalysts and diesel particulate filters have come to be fitted to diesel vehicles,

however, the sulfides arising from sulfur in fuel cause such equipment to quickly deteriorate and so on. For this reason, in advanced countries, the low-sulfurization of fuel is being advanced, and lubricant is added to low-sulfur light oil to assist lubrication of fuel injection devices.

In setting the specifications of equipment to be procured in the Project, it is necessary to adopt engine specifications that correspond to the quality of diesel engine light oil available on the local market in Ethiopia. So far, European emission standards have progressed sequentially from EURO I (enforced in 1992) to EURO VI (enforced in 2014). Table 2-2.6 shows values of European emission standards (pollutant upper limit values) for equipment fitted in diesel engines, as well as the sulfur content upper limit values indicating the quality that corresponds to these control values.

Table 2-2.6 Values of European Emission Standards and Sulfur Content Upper Limit Values in Diesel Engines

Enforced year	Standard name	Pollutant upper limit values(g/km)				Sulfur content upper limit value (ppm) <sup>(Note)</sup>
		Carbon monoxide (CO)	Hydrocarbon (HC)	Nitrogen oxide (NO <sub>x</sub> )	Particulate matter (PM)	
1992	EURO I	3.16	1.13	0.78	0.14	2,000 (0.2%)
1996	EURO II	1.00	0.90	0.73	0.10	500 (0.05%)
2000	EURO III	0.67	0.56	0.50	0.50	350 (0.035%)
2005	EURO IV	0.50	0.30	0.25	0.25	50 (0.005%)
2008	EURO V	0.50	0.05	0.18	0.05	10 (0.001%)
2014	EURO VI	0.50	-	0.80	0.05	10 (0.001%)

Note) 1ppm = 0.0001%

Source: Prepared by the Survey Team based on the Final Report on Pilot Global Fuel Economy Initiative Study in Ethiopia and hearings

In recent years, emission standards have been adopted by countries around the world in consideration of the environment and so on. In contrast, as of 2019, Ethiopia adopts no emission standards, although it has introduced regulations on fuel content. In other words, in the case of light oil, since 2016, sulfur content is regulated to between 500~2,000ppm, which corresponds to quality equivalent to EURO I~II.

Meanwhile, concerning fuel actually available on the domestic market in Ethiopia, the results of surveys targeting the period between 2004~2015 have been compiled. As is shown in Table 2-2.127, since 2013, although there are fluctuations in the quality of fuel, light oil having sulfur content corresponding to EURO III (350ppm or less) has been available on the local market.

Table 2-2.7 Changes in Sulfur Content of Fuel in Ethiopia

Year	Average sulfur content (ppm)	Minimum sulfur content (ppm)	Maximum sulfur content (ppm)
2004	9,130	7,000	9,900
2005	6,100	3,100	9,700
2006	4,990	1,400	9,500
2007	4,480	2,800	4,800
2008	4,410	4,000	9,300
2009	4,770	3,800	4,900
2010	4,580	3,400	5,000
2011	4,690	4,000	5,000
2012	4,750	4,700	4,800
2013	1,855	243	4,800
2014	805	269	1,800
2015	925	245	1,850

Source: "Urban Air Quality Management in Ethiopia (CSE), 2016"

Under the circumstances described above, recently in Ethiopia, procurement of equipment and vehicles that are compatible with EURO II~III emission standards has become commonplace. For that reason, in recent years, local agents are increasingly supplying equipment and vehicles that comply with EURO II and EURO III to AACRA. Meanwhile, concerning engine breakdowns arising from fuel quality, local agents have received no reports whatsoever about breakdowns in EURO II~III equipment, although breakdowns have been reported in EURO IV equipment.

In consideration of the above local conditions, the engines planned for procurement in the Project will have specifications and performance that comply with the EURO II~III emission standards.

Moreover, in Ethiopia, measures geared to the introduction of exhaust gas controls are being advanced under the initiative of the Standards Agency under the jurisdiction of the Ministry of Science and Technology. The following standards have been compiled in "Urban Air Quality Management in Ethiopia", which was announced by the Centre for Science and Environment (CSE) in 2016.

- In Ethiopia's neighboring countries of Kenya, Uganda, Rwanda, Brunei, and Tanzania, sulfur content is controlled at a level of 50ppm (EURO IV).
- From the viewpoint of following suit with its neighbors, too, it is important for Ethiopia to introduce emission standards that correspond to EURO IV, and the impact of quickly introducing standards to limit sulfur content to no more than 500ppm (corresponding to EURO II) will be substantial.
- Since 2016, Ethiopia has been developing draft emission standards for vehicles.

## 2) Spare Parts Procurement Situation

In the Project, AACRA performs road maintenance in Addis Ababa city of 420km in three years (140km a year). Periodical check and the exchange of the spare part are necessary to operate procured equipment at an appropriate standard. After the delivery of the equipment, it is necessary for AACRA to procure certainly the spare part for 1,000 hours, which is assumed to be needed annually, to promote road maintenance smoothly.

On the other hand, uncertainty of the spare part procurement caused by the lack of foreign currency



is a problem.

Considering such situation, the spare parts for minimum of 3,000 hours for main equipment is procured to achieve road maintenance that AACRA performs in three years surely.

In addition, after consuming the spare parts of 3,000 hours, it is necessary for AACRA to purchase them in the situation of the lack of foreign currency. Based on this, capacity enhancement for the spare parts management by the introduction of equipment management system is carried out with the soft component in the Project, in order to comprehend the cycle of spare parts exchange depending on the situation of equipment operation and draw up the spare parts additional procurement plan that enables prediction of purchase time and foreign currency preparation.

### 3) Asphalt Mixture Procurement Situation

Two of four existing asphalt plants were procured under the Government of Japan's grant aid in 1996. Although these Japanese-made plants have surpassed their service life and their production capacity has fallen to around 40~50% of their specified value, AACRA continues to operate them while conducting the required maintenance work. Meanwhile, the Chinese-made asphalt plants that AACRA purchased under its own budget a few years ago are experiencing continuous difficulties and are currently undergoing maintenance.

Under the circumstances described above, when AACRA purchases asphalt mixture from private company, the cost is more expensive than in-house production and sometimes it is impossible to purchase a small amount. As a result, problems are arising in that it is not possible to implement prompt repair works and so on. Table 2-2.8 shows the breakdown of annual consumption and annual production of asphalt mixture for use in road construction and maintenance by AACRA.

Table 2-2.8 Breakdown of Annual Consumption and Production of Asphalt Mixture for Road Construction and Maintenance by AACRA

Asphalt mixture annual consumption (①=②+③)	Production by AACRA		Private sector procurement	
	Quantity ②	Material unit rate (ETB/m <sup>3</sup> )	Quantity ③	Material unit rate (ETB/m <sup>3</sup> )
87,000 m <sup>3</sup> (200,000 tons)	39,000 m <sup>3</sup> (90,000 tons)	3,500	48,000 m <sup>3</sup> (110,000 tons)	6,210

Source: Prepared by the Survey Team based on the data from AACRA

The difference in prices for asphalt mixture between AACRA and the private sector as shown in Table 2-2.8 arises due to the factors described below.

- AACRA can obtain aggregate for free because it owns a quarry, however, the private sector purchase aggregate for manufacturing.
- Because AACRA owns an asphalt plant, it only incurs operating costs.
- There are differences between the private sector and AACRA in terms of personnel expenses.
- Due to inadequate competition in the private sector, indirect costs and profit are set high.

Table 2-2.9 shows a comparison of the costs of asphalt mixture production between AACRA and private sector.

**Table 2-2.9 Comparison of Asphalt Mixture Production Costs between AACRA and Private Sector**

Item	Unit	Rate (ETB)	AACRA			Private sector operators		
			Quantity (/m <sup>3</sup> )	Price (ETB/m <sup>3</sup> )	Remark	Quantity (/m <sup>3</sup> )	Price (ETB/m <sup>3</sup> )	Remark
Asphalt emulsion	ton	21,000	0.15	2,850		0.15	2,850	
Coarse aggregate	m <sup>3</sup>	176	0.20	0	Free, due to ownership of a quarry	0.20	50	
Fine aggregate	m <sup>3</sup>	220	0.70	0		0.70	214	
Other (filler)	m <sup>3</sup>	330	0.10	0		0.10	47	
Plant/equipment costs (/m <sup>3</sup> )	m <sup>3</sup>	486	0.25	178	Operating costs only (25%)	1	678	
Personnel costs (/m <sup>3</sup> )	m <sup>3</sup>	15	1	15		1	18	
Indirect costs and profit (40%)	-	-	-	0		-	1,543	
Tax (15%)	-	-	-	457		-	810	
<b>Total</b>	<b>m<sup>3</sup></b>	<b>-</b>	<b>-</b>	<b>3,500</b>		<b>-</b>	<b>6,210</b>	

Source: Prepared by the Survey Team based on the data from AACRA



In consideration of the above points and the plant situation in Ethiopia, where the cost of procurement of materials from private companies has been rising, it is deemed necessary to procure an asphalt plant to supply the necessary materials for the expected scale of works. In addition, the specifications of the asphalt plant to be procured will be set based on the amount of asphalt mixture required per year for the asphalt pavement work implemented by AACRA.

#### **(5) Policy Regarding Pavement Repair Methods Using Special Equipment**

A pavement overlay is performed repeatedly on the road in Addis Ababa City as pavement repair with the traffic increase. Therefore, a road surface swells to height of curbstone or more and a problem occurs for disposal of rainwater and waste water. As a pavement repair method to solve the problem described above, Road Stabilizer will be procured in this Project. This equipment has a purpose of stabilizing existing roadbeds to reduce pavement thickness. This is effective for the recovery and reinforcement of the strength degradation by the aging degradation of the pavement and subgrade.

In performing subgrade improvement with this equipment, the structures such as a catch basin, the manhole established in Addis Ababa City disturb the construction. The specifications of Road Stabilizer made in Japan and Germany, which have major manufacturers of Road Stabilizer that have widely exported to various countries, were compared for the compatibility for such road condition. Table 2-2.10 shows comparison of applicability of 2 equipment. Figure 2-2.2 shows the working simulation along the road shoulder where catch basin commonly exist within 2-line carriageway (approx. 8m in width) in Addis Ababa city.

Table 2-2.10 Comparison of Two Types of Road Stabilizer

Type		Made in Japan	Made in Germany		
Picture					
Construction efficiency	Rotor	Width : 2,000mm Function to shift 500mm to right and left	○	Width : 2,000mm The rotor is partial on the right side ( function to shift is not installed)	△
	Minimum turning radius	11.3m	△	7.0m (An anteroposterior tire turns)	○
	The number of mixing <sup>Note1</sup> (Road width : 8m)	5 times	○	5 times	○
	Confirmation method of mixing	A cockpit is established just above the rotor, and confirmation by the visual observation is possible	○	Confirmation with monitor from cockpit	△
	Adaptability of the construction method for the road in Addis Ababa City	The rotor shift function enables construction of the road shoulder and center side of the road and construction avoiding the structure on the road. (Refer to Figure 2-2.2)	○	The rotor established on the right side enables construction close to the road shoulder. (Refer to Figure 2-2.2)	○
	Impact on traffic	In the roads of Addis Ababa City where catch basin and manholes exist on the roadway, it is considered to perform efficient work utilizing the function of the rotor shifting left and right. In addition, the rotor shift function allows close construction of the left and right shoulders within the range of 8m width. Therefore, the	○	Since the rotor is on the right side of the vehicle body, it is difficult to bring the rotor close to the pavement end on the left side in the traveling direction (the median strip side in Addis Ababa City). Therefore, it is necessary to turn the vehicle body when it is used for construction on the median strip side. Since it requires a	△

		<p>impact on traffic outside the construction site is considered to be small.</p> <p>On the other hand, since the minimum turning radius is larger than that of equipment made in Germany, it is disadvantageous in terms of work efficiency. It is necessary to fully consider the impact on construction procedures and traffic condition at each construction site.</p>	<p>minimum turning radius of 7.0 m, it is not able to turn within a width of 8 m.</p> <p>As a countermeasure, it is necessary to plan in advance an area necessary for turning or turning the vehicle an intersection, a roundabout, a neighborhood. In particular, when turning at intersections, it is important to take measures to reduce the impact on traffic as much as possible. For example, it is important to considerate traffic regulations in advance based on traffic congestion on the roads in Addis Ababa City.</p>
<p>Evaluation</p>		<p>It is considered that the two types of equipment are applicable to roads in Addis Ababa City.</p> <p>Road Stabilizer made in Japan has an effective rotor shift function that can handle road conditions in Addis Ababa City, but it requires a construction plan according to specifications such as the minimum turning radius.</p> <p>For introduction of Road Stabilizer made in Germany, construction plan including the traffic regulations such as intersections is important regarding the characteristics of the specifications mentioned above.</p>	

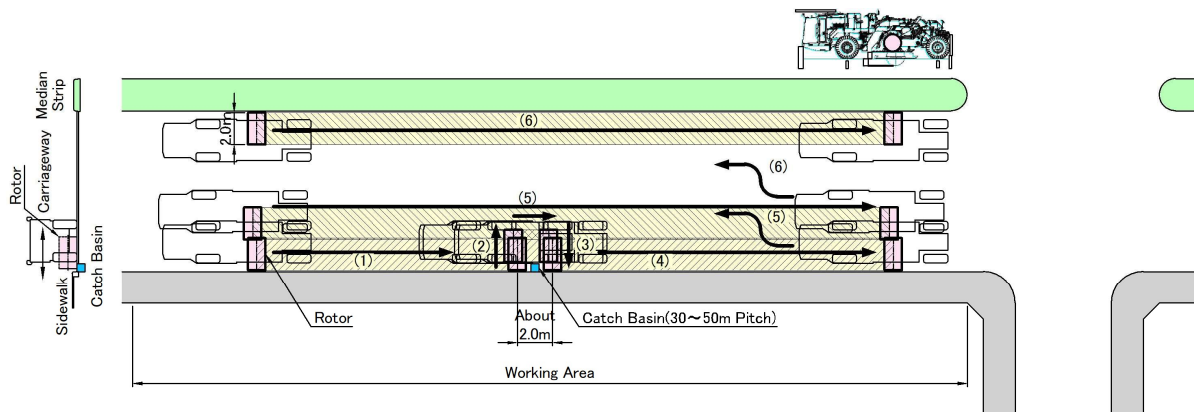
Note 1) The number of times required to complete the agitation work around the catch basin if there is a catch basin at the end of the road pavement.

Source: Prepared by the Survey Team

## Japanese Product

### Construction procedure

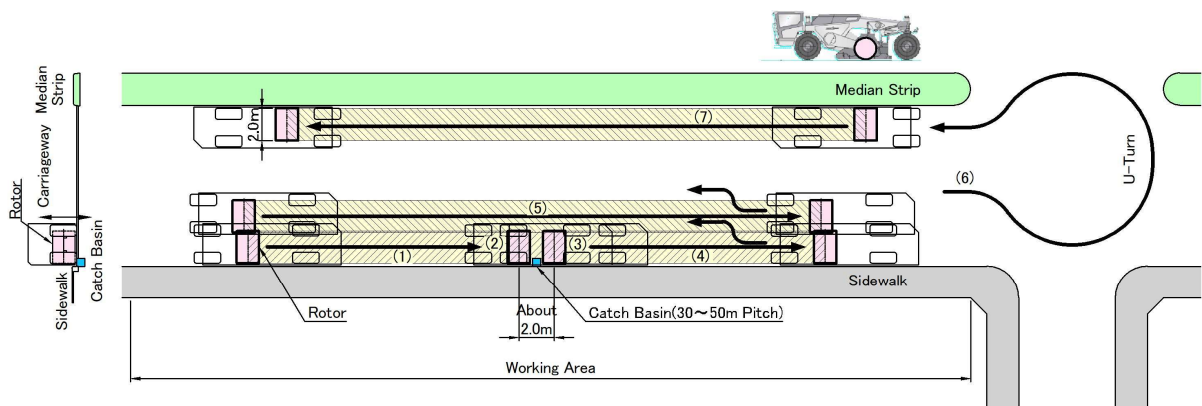
- (1) Set the rotor at the edge of the right side curbstone and start mixing.
- (2) Shift the rotor just before the catch basin. The equipment is kept same position.
- (3) Shift the rotor at the edge of to the right curbstone again, after the equipment moves over to the other side of the catch basin.
- (4) Mix to the end of the working area. (first mixing work is finished)
- (5) Back to the starting point and mix to the end of the working area. (Continue same mixing work)
- (6) Set the rotor at the edge of the left side, and mix to the end of the working area.



## German Product

### Construction procedure

- (1) Set the equipment at the edge of the right side curbstone and start mixing.
- (2) Lift up the rotor just before the catch basin.
- (3) Push the rotor down at the position after the equipment moves over to the other side of the catch basin.
- (4) Mix to the end of the working area. (first mixing work is finished)
- (5) Back to the starting point and mix to the end of the working area. (Continue same mixing work)
- (6) The equipment has to do U-turn at the out of the working area.
- (7) Set the equipment at the opposite side and start mixing.



Source: Prepared by the Survey Team

Figure 2-2.2 Road Stabilizer Working at the Edge of the Curbstone with Catch Basin

The effective utilization of the Road Stabilizer is expected, but it is the first time that Road Stabilizer is introduced to AACRA. Therefore, the policy is to transfer technology for operational guidance at the obligation of recipient country to increase the strength of the base course using lime in addition to the initial operation training at the handing over of the equipment. The operational guidance consists of laboratory test and on site mixing.

## **(6) Policy Regarding Operation and Maintenance**

Initial operation training of equipment procured in the project will be provided as an on-the-job training (OJT) by instructors from manufacturers using operation and maintenance manuals at handing over. In addition, the soft component aimed at building a sustainable operation and maintenance system utilizing the private sector will be planned to ensure the proper operation and maintenance of the equipment.

In the soft component, the introduction and operation support of the equipment management system, the trouble diagnostic training and making their manual covering the equipment of the Project will be implemented for the staff in charge of the equipment of AACRA.

## **(7) Policy Regarding the Grade of Equipment and Facility**

The following conditions are developed based on the field survey result and considered policies as above:

The duration of the road maintenance work for target length should be three (3) years.

- The maintenance work in the target area consists mainly of maintenance and repair of existing pavements and drainage facility. Therefore, the equipment should consist mainly of equipment for paving work and cleaning drainage facility.
- Maintenance of the facilities such as streetlights and vehicle guard fences in Addis Ababa City are also under management of AACRA, therefore equipment for maintenance of these facility should be procured.
- Existing equipment owned by AACRA that can be used for the Project should be utilized as far as possible.
- Since AACRA does not carry out the medium or larger pavement works during rainy season from July to September, the main road maintenance and repair work shall be planned annually for 9 months.

Taking the above conditions into consideration, the maintenance equipment for the Project should be composed of equipment for paving work, cleaning drainage facility, maintaining streetlights and other facilities, and facility for producing pavement material (asphalt plant), and mobile workshop for maintenance of equipment, and equipment and tools for repair and maintain these equipment.

## **(8) Policy Regarding Implementation Schedule**

Table 2-2.11 shows the estimated volume of main works on target roads (420km, 140km / year) in the Project.

Table 2-2.11 Estimated Volume of Main Works (420km, 140km/year)

Item	Specifications	Unit	Volume
Base Course (Upper base course)	t=15cm	m <sup>2</sup>	1,470,000
		m <sup>3</sup>	220,500
Base Course (Lower subbase course)	t=30cm	m <sup>2</sup>	735,000
		m <sup>3</sup>	220,500
Base course compaction		m <sup>2</sup>	2,940,000
Asphalt pavement (Surface course)	t=4cm	m <sup>2</sup>	2,940,000
		m <sup>3</sup>	117,600
Asphalt pavement (Binder course)	t=6cm	m <sup>2</sup>	1,470,000
		m <sup>3</sup>	88,200
Base course leveling		m <sup>2</sup>	3,675,000
Water spray amount		m <sup>3</sup>	4,160
Prime coat		m <sup>2</sup>	2,940,000
Tack coat		m <sup>2</sup>	2,940,000
Aggregate supply for asphalt plant		m <sup>3</sup>	185,041
Side ditch excavation (L type)	Excavation width: w=0.5m, Excavation height: h=0.4m	m <sup>3</sup>	50,400
Side ditch excavation (U type)	Excavation width: w=0.5m, Excavation height: h1=0.1m, h2=0.2m	m <sup>3</sup>	44,100

Source: Prepared by the Survey Team

The AACRA shall implement road maintenance of the above estimated volume of main works in three years after the delivery of equipment to be procured in the Project.

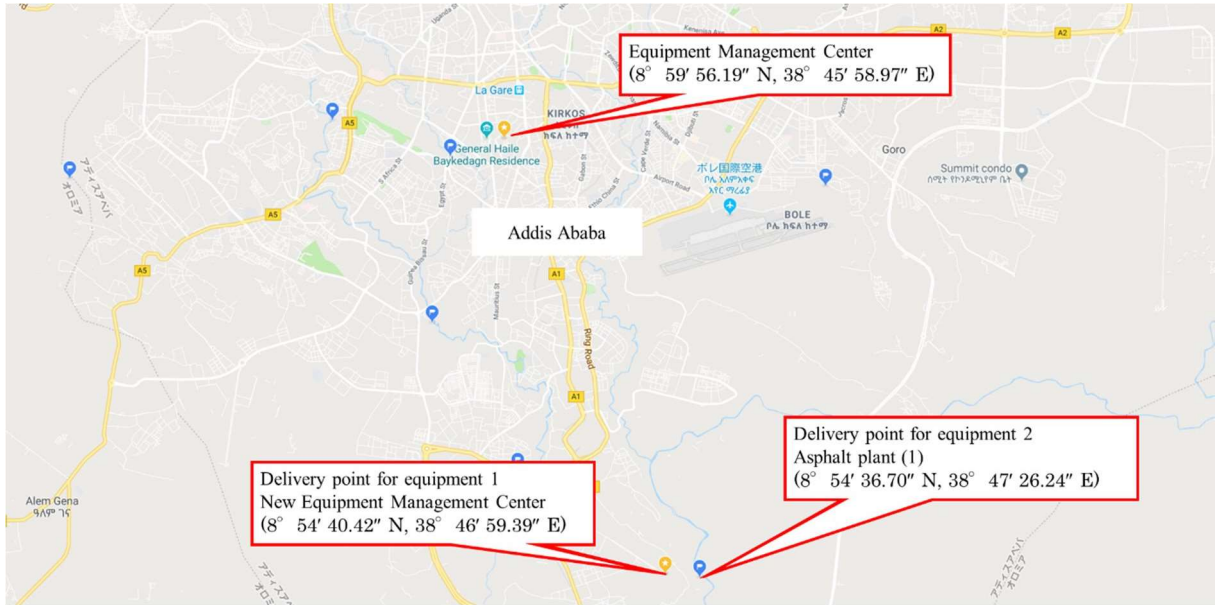
## 2-2-2 Basic Plan

### (1) Overall Plan

The survey team studied the place of delivery of equipment to be procured in the Project with focus on the AACRA's relevant facilities considering the efficiency and ease of equipment operation and maintenance, facilities capacity as equipment storage location and security of surrounding area. The survey team concluded that the following places are the most appropriate for the delivery after discussions with AACRA as well as a field survey:

- ① New Equipment Management Center (Akaki Kaliti district in Addis Ababa City, completed by October 2020)  
All the equipment and spare parts except the asphalt plant will be delivered to this new center.
- ② The Existing Asphalt Plant Site (Akaki Kaliti district in Addis Ababa City)  
The new asphalt plant to be procured in the Project will be installed in the existing asphalt plant site of AACRA.

Figure 2-2.3 shows the locational map of the equipment delivery locations.



Source: Prepared by the Survey Team

Figure 2-2.3 Location Map of the Equipment Delivery Points

Figure 2-2.4 and Figure 2-2.5 shows location map of each delivery place.



Source: Prepared by the Survey Team

Figure 2-2.4 Location Map of Equipment (Except Asphalt Plant) Delivery Site





Source: Prepared by the Survey Team

Figure 2-2.5 Location Map of Asphalt Plant Delivery Site

## (2) Equipment Plan

Road maintenance equipment and workshop equipment required by the Project are shown as below.

### 1) Road Maintenance Equipment

Road maintenance equipment to be procured in the Project should be composed of equipment for paving work, cleaning drainage facility, maintaining streetlights and other facilities, and facility for producing pavement material (asphalt plant), and mobile workshop for maintenance of equipment, and equipment for repair and maintain these equipment. In determining the quantity and specification of each road maintenance equipment, the following conditions are taken into consideration:

- The equipment should have a capacity and be fully equipped to carry out road maintenance works in the target road efficiently.
- The number of equipment should be sufficient to carry out the road maintenance works in the target road efficiently.
- Size and weight of the equipment should be suited to the conditions of the construction site.
- The equipment can be safely operated
- The equipment can be operated in a way without harming operator's health.
- Based on the geographical environment where the target area is located on a highland with an altitude of 2,300-2,600m and hilly terrain, the engine specification should have sufficient drive performance suitable for this geographical environment.
- Operation cost or maintenance cost of the equipment should not impose a heavy burden.
- Equipment should have mobility adequate to carry out the road maintenance work.

The types, quantities, purposes and basic specifications of the selected road maintenance equipment and workshop equipment for the Project are shown in Table 2-2.12.

**Table 2-2.12 Road Maintenance Equipment of the Project,  
Purpose of Use and Basic Requirement**

No.	Name of Equipment	Specification	Quantity	Purpose of Use (Upper) Basic Requirements (Lower)
1	Wheel Loader	Bucket capacity: not less than 2.8 m <sup>3</sup> Operation weight: less than 17t Engine output: not less than 120 kW Dumping clearance: not less than 2.6 m	3	Stockpiling/loading materials for pavement work. Its bucket size and working rang should suit the size of dump track for loading materials and the hopper of the asphalt plant.
2	Backhoe Loader	Bucket capacity: Approx. 0.3 m <sup>3</sup> Maximum digging depth: not less than 4 m Maximum digging height: not less than 5 m Operation weight: less than 9,700 kg Engine output: not less than 70 kW	7	Remove pavement layer and excavate the drainage ditch and pipe. The equipment should be equipped with a favorable mobility and capacity in the working sites.
3	Excavator	Operation weight: 4,000–5,200 kg Bucket capacity: not less than 0.1 m <sup>3</sup> Engine output: not less than 28 kW	5	Remove pavement layer and excavate the drainage ditch and pipe in narrow roads. The equipment should be equipped with a favorable mobility and capacity in the narrow roads.
4	Road Stabilizer	Operation weight: 22,000–26,500 kg Engine output: not less than 300 kW Mixing width: not less than 2 m Mixing depth: not less than 400 mm	1	Reinforcement of sub base and base course on the site. The equipment should be equipped with a favorable cutting depth and mixing of the sub-base and base course.
5	Sheep Foot Compactor	Operation weight: not less than 10t Engine output: not less than 80 kW Pad foot roll with removable flat roll shell Centrifugal Force: not less than 200 kN Dimension of the Roll (width): Approx. 2,100 mm	5	Compacting subgrade, sub-base and base course The equipment should be equipped with suitable operation weight and centrifugal force for compacting of subgrade and base course.
6	Vibratory Tandem Roller	Operation weight: not less than 3,900 kg Engine output: not less than 29 kW Centrifugal Force: not less than 24 kN Dimension of the Roll (width): Approx. 1,350 mm	5	Compacting sub-base, base course /binder, surface course The equipment should be equipped with suitable capacity for compacting work.
7	Tyre Roller	Operation weight: 8 ~ 15t Engine output: not less than 65 kW Travel Speed: 0 ~ 19 km/h Dimension of the Roll (width): not less than 2,000 mm	3	Compacting sub-base, base course /binder, surface course The equipment should be equipped with suitable capacity for compacting of base, binder, and surface course.
8	Water Truck	Payload: not less than 10t (10,000 t) Operation Weight (GVW): less than 23t Engine output: not less than 150 kW Left-hand Steering	3	Spray cooling water during the asphalt pavement work, water supply to compaction equipment, adjustment of moisture content of subgrade and base course, and water sprinkling for cleaning/ dustproof etc. The equipment should be equipped with suitable water tank and vehicle capacity for pavement works and water spraying.
9	Dump Truck	Rear dump type, U-shaped body Payload: not less than 14t Body capacity: Approx. 14m <sup>3</sup> Operation Weight (GVW): less than 26t Engine output: not less than 190 kW Left-hand Steering	10	Hauling the road maintenance materials and asphalt mixture. The equipment should be equipped with dump vessel 14m <sup>3</sup> (14 ton)

No.	Name of Equipment	Specification	Quantity	Purpose of Use (Upper) Basic Requirements (Lower)
10	Cab-back Crane (3t)	Flat body cargo truck with 3t crane Payload: not less than 10t Engine output: not less than 190 kW Left-hand Steering	2	Loading/unloading/transport of materials and equipment The equipment should be suitable capacity of loading/ unloading/ transport of materials and equipment.
11	Cab-back Crane (8t)	Flat body cargo truck with 8t crane Payload: not less than 10t Engine output: not less than 190 kW Left-hand Steering	1	Loading/unloading/transport of large-scale materials and equipment The equipment should be suitable capacity of loading/ unloading/ transport of materials and equipment.
12	Aerial Work Platform Vehicle	Platform maximum height: not less than 14.5 m Bucket payload: not less than 200 kg (2 person) Left-hand Steering	4	Maintenance of road accessories such as street lights The equipment should be suitable platform capacity to work at height places safely.
13	High-pressure Drainage Cleaning Vehicle	Water tank capacity: Approx. 6,000 ℓ Pumping pressure: not less than 14 MPa Pumping Capacity: Approx. 180 ℓ /min. Hose length: Approx. 80 m Left-hand Steering	3	Cleaning of drain pipe and ditch The equipment should be suitable work capacity for clean drainage.
14	Vacuum Tank Truck	Tank capacity: not less than 6,500 ℓ Vacuum pump: Rotary Vane type or Blower type Suction Pressure: -96kPa Discharge Rate: not less than 20m <sup>3</sup> /min. Left-hand Steering	3	Cleaning of drain pipe and ditch The equipment should be suitable work capacity for clean drainage.
15	Bitumen Distributor	Tank capacity: not less than 4,000 ℓ Engine output: not less than 115kW Pumping Capacity: not less than 300ℓ/min. Spray width: not less than 3,600mm Left-hand Steering	3	Transport/spraying/storage/melting asphalt and asphalt emulsion The equipment should have functions to efficiently transport and spray prime coat / tack coat on base course and binder course.
16	Asphalt Burner	Propane or LPG Gas Burner Max. flame temperature: not less than 1,200°C Length of the Burner Handle (Lance): Approx. 1.0 m	5	Repair works of asphalt pavement The equipment should heat the joints of asphalt sufficiently.
17	Asphalt Cutter	Petrol Engine Wet type Max. Cutting Depth: not less than 170 mm	5	Cutting asphalt pavement The equipment should have adequate cutting depth
18	Asphalt Crack Sealer	Petrol Engine Kettle capacity: not less than 50 ℓ Propane or LPG Gas Burner	5	Repair works of asphalt pavement The equipment should inject into asphalt joints sufficiently.
19	Air Compressor	Screw compressor, Trailer type Air pressure: Approx. 0.7 MPa Pumping Capacity: not less than 7.0 m <sup>3</sup> /min.	4	Repair works of asphalt pavement The equipment should have discharging capacity and pressure for air breaker.
20	Air Breaker	Weight: Approx. 20 kg Number of blow: Approx. 1,000 bpm	5	Repair works of asphalt pavement The equipment should be handy and have suitable capacity for mall-scale asphalt pavement.
21	Asphalt Mixer	Trailer: Two (2) wheels Production Capacity: Not less than 4.0 ton/hr. Engine output: not less than 14kW	3	Production of asphalt mixture on small scale sites. The equipment should have production capacity for asphalt pavement repair.

No.	Name of Equipment	Specification	Quantity	Purpose of Use (Upper) Basic Requirements (Lower)
22	Asphalt Plant	Batch type Capacity: 80t/h <u>Constitution</u> Aggregate supply equipment / dryer / screen / hot bin / scale / mixer / bag filter / control unit / asphalt supply equipment / asphalt piping heater and cleaning equipment / generator (power supply)	1	Production of hot asphalt mixture for pavement The equipment should have adequate production capacity
23	Mobile Workshop	With 3,000kg crane Cargo body: 15 ft. Equipment and tools required for maintenance (Generator-cum-Welder, Air Compressor, High pressure Washer, Measuring Instruments, etc.)	1	Repair/ maintain equipment at the project site The carrier should be equipped with set of workshop equipment, and tools for maintenance service at the maintenance work site.

Source: Prepared by the Survey Team

## 2) Workshop Equipment

The Survey Team also studied whether workshop equipment required for repair and maintenance of road maintenance equipment to be procured in the Project. The details (basic specifications and quantity to be procured) as well as the purpose of the use the workshop equipment are summarized in Table 2-2.13.

Table 2-2.13 Workshop Equipment of the Project, Purpose and Basic Requirements

No.	Name of Equipment	Specification	Quantity	Purpose of Use (Upper) Basic Requirements (Lower)
1	Container Workshop	Container type warehouse: 20ft. Equipment and tools required for maintenance (Generator-cum-Welder, Air Compressor, High pressure Washer, Measuring Instruments, Buttery Charger, Electric Tools, etc.)	1	For maintenance and repair of vehicles and equipment The workshop will be equipped with equipment and tools for maintenance service at the equipment management center.
2	Tyre Changer	Electric Motor driven type Wheel Size: 14 ~ 46 inch Maximum Tire Diameter: 2,000 mm	2	Repair and change for heavy vehicle and equipment tyre The equipment should have functions for heavy vehicles and equipment.
3	Portable Gantry Crane	Manual chain block with gear trolley Rated load: not less than 5,000 kg Standard lift: Approx.3,000 mm	2	Desorption for heavy vehicle and equipment parts The equipment should have a enough lifting capacity for heavy vehicle and equipment parts.
4	Wheel Dolly	Ability: not less than 500 kg Tire diameter: 750 ~ 1,430 mm	2	Desorption for vehicle and equipment wheel The equipment should have a capacity for heavy vehicle and equipment.
5	High Pressure Washer	Petrol Engine Pressure: not less than 10 Map Discharge volume: not less than 7 l /min	5	Cleaning for equipment The equipment should be small, lightweight and easy to carry.
6	Hot Water High Pressure Washer	Pressure: Approx. 10MPa Volume: Approx. 800l /min Temperature: normal temperature ~ 80°C or more	1	Cleaning of repair equipment vehicle The equipment should have adequate discharge pressure and capacity that can clean oil stains and mud stains.
7	Engine Driven Welding Generator	Diesel Engine Driven Generation capacity: not less than 15kVA Engine power: not less than 15kW	2	Repair and maintenance for equipment The equipment should have adequate rated output to operate electric tool and several welding.

No.	Name of Equipment	Specification	Quantity	Purpose of Use (Upper) Basic Requirements (Lower)
8	AC Arc Welder	Rated input: not less than 18kVA Rated output: not less than 300A	4	Repair and maintenance for equipment The equipment should be movable and have adequate welding current to weld equipment.
9	Portable Motor Driven Air Compressor	Pressure: not less than 0.9MPa Tank capacity: not less than 80 l	2	Cleaning for equipment The equipment should be movable and have adequate pressure and capacity to operate air tools.
10	Parts Washing Stand	Capacity: not less than 40 l Size: Approx. 1,200x550x150mm	3	Cleaning for equipment parts The equipment should have adequate function and capacity to clean equipment parts.
11	Jacks	Composed by five types below, (1) Garage Jack (a) Lifting load: not less than 3 t Lifting capacity: Approx. 500 mm (2) Garage Jack (b) Lifting load: not less than 5 t Lifting capacity: Approx. 560 mm (3) Garage Jack (c) Lifting load: not less than 10 t Lifting capacity: Approx. 550 mm (4) Transmissions Jack (heavy) Lifting load: not less than 12 t (5) Transmissions Jack (small) Lifting load: not less than 0.45 t	2	Lifting for repair parts The equipment should be able to jack up small to heavy vehicles and transmissions.
12	Desktop Computer	OS: Windows 10 or more CPU: i3 or more, not less than 3.3GHz HD: not less than 500GB	1	Equipment management system The equipment should be the latest model.
13	Database Software	File maker: Pro 17 or updated version	1	Equipment management system The equipment should be the latest version.

Source: Prepared by the Survey Team

### (3) Quantities of Equipment

#### 1) Estimated Volume of Earthworks and Pavement Works

In the fiscal year 2018, when the annual budget for road maintenance increased, AACRA performed 113km of road maintenance by renting equipment in addition to the equipment owned by AACRA. On the other hand, before the fiscal year 2017, 50km of road maintenance was performed only with the equipment owned by AACRA. (See Table 2-2.2)

Therefore, estimated volume of earthworks and pavement works for estimating the quantities of road maintenance equipment will be the quantity for 90 km excluding 50 km that can be covered only by the equipment owned by AACRA out of the 140 km of annual road maintenance Length in the Project.

Estimated volume of earthworks and pavement works are shown in Table 2-2.14. These quantities are estimated based on the estimated volume of main works for 270km (90km / year) shown in Table 2-2.15.

Table 2-2.14 Estimated Volume of Earthworks and Pavement Works

Equipment	Volume	Unit	Purpose of Use
Wheel Loader	118,955	m <sup>3</sup>	Aggregate supply to asphalt plant
Backhoe Loader	415,800	m <sup>3</sup>	Stockpiling/loading of the road construction material
Excavator	60,750	m <sup>3</sup>	Excavating/loading the side ditch
Road Stabilizer	1,890,000	m <sup>2</sup>	Pavement improvement
Sheep Foot Compactor	4,252,500	m <sup>2</sup>	Compacting of roadbed, base leveling
Vibratory Tandem Roller	4,725,000	m <sup>2</sup>	Compacting of roadbed/pavement
Tire Roller	4,725,000	m <sup>2</sup>	Compacting of roadbed/pavement
Dump Truck	132,300	m <sup>3</sup>	Hauling the road construction materials
Bitumen Distributor	3,780,000	m <sup>2</sup>	Asphalt pavement
Asphalt Plant	310,905	t	Production of asphalt mixture

Source: Prepared by the Survey Team

Table 2-2.15 Estimated Volume of Main Works (270km, 90km/year)

Item	Specifications	Unit	Volume
Base Course (Upper base course)	t=15cm	m <sup>2</sup>	945,000
		m <sup>3</sup>	141,750
Base Course (Lower subbase course)	t=30cm	m <sup>2</sup>	472,500
		m <sup>3</sup>	141,750
Base course compaction		m <sup>2</sup>	1,890,000
Asphalt pavement (Surface course)	t=4cm	m <sup>2</sup>	1,890,000
		m <sup>3</sup>	75,600
Asphalt pavement (Binder course)	t=6cm	m <sup>2</sup>	945,000
		m <sup>3</sup>	56,700
Base course leveling		m <sup>2</sup>	2,362,500
Water spray amount		m <sup>3</sup>	4,160
Prime coat		m <sup>2</sup>	1,890,000
Tack coat		m <sup>2</sup>	1,890,000
Aggregate supply for asphalt plant		m <sup>3</sup>	118,955
Side ditch excavation (L type)	Excavation width: w=0.5m, Excavation height: h=0.4m	m <sup>3</sup>	32,400
Side ditch excavation (U type)	Excavation width: w=0.5m, Excavation height: h1=0.1m, h2=0.2m	m <sup>3</sup>	28,350

Source: Prepared by the Survey Team

## 2) Quantities of Equipment

The quantities of road maintenance equipment to be procured by the Project is estimated based on the estimated volume of earthworks and pavement works (Table 2-2.14) and by taking the organizational structure of AACRA into account.

The quantities and grounds for the estimated quantities of road maintenance equipment are shown in Table 2-2.16.

**Table 2-2.16 Bases for Estimation of Required Quantities of Road Maintenance Equipment**

1. Wheel Loader (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
Bucket capacity	2.8 m <sup>3</sup>	
Cycle time	240 sec.	Average cycle time for loading aggregate
Quantity of work/machine/h	11 m <sup>3</sup> /h	
Quantity of work/machine/day (1)	77 m <sup>3</sup> /day	7 hours/machine/day
Working days/year	200 days	22 days/month × 9 months
Estimated period of the work	3 years	After delivery of the construction machines
Estimated amount of work-volume (2)	118,955 m <sup>3</sup>	Estimated work-volume,
Work period	3 years	
Required working days to complete the work (3)	600 days	Loading/piling up materials for asphalt plant
Required work-volume/day (4) = (2) ÷ (3)	198 m <sup>3</sup> /day	
Required number of machines = (4) ÷ (1)	3 units	2.57 units

2. Backhoe Loader (estimated quantity: 7 units)

Basis of Calculation	Numerical Value	Remarks
Bucket capacity (Loader)	1.0 m <sup>3</sup>	
Cycle time	90 sec.	Average cycle time for removing soil and ripping asphalt
Quantity of work/machine/h	19 m <sup>3</sup> /h	
Quantity of work/machine/day	95 m <sup>3</sup> /day	5 hours/machine/day
Bucket capacity (Backhoe)	0.3 m <sup>3</sup>	
Cycle time	150 sec.	Average cycle time for excavation and ripping asphalt
Quantity of work/machine/h	3 m <sup>3</sup> /h	
Quantity of work/machine/day	6 m <sup>3</sup> /day	2 hours/machine/day
Total quantity of work/machine/day (loader & backhoe)	101 m <sup>3</sup> /day	7 hours/machine/day
Working days/year (embankment material)	200 days	22 days/month × 9 months
Estimated period of the construction work	3 years	After delivery of the construction machines
Estimated amount of work-volume (2)	415,800 m <sup>3</sup>	Estimated work-volume,
Work period	3 years	
Required working days to complete the work (3)	600 days	
Required work-volume/day (4) = (2) ÷ (3)	693 m <sup>3</sup> /day	
Required number of machines = (4) ÷ (1)	7 units	6.86 units

3. Excavator (estimated quantity: 5 units)

Basis of Calculation	Numerical Value	Remarks
Bucket capacity	0.1 m <sup>3</sup>	
Cycle time	60 sec.	Average cycle time for excavation
Quantity of work/machine/h	3 m <sup>3</sup> /h	
Quantity of work/machine/day (1)	21 m <sup>3</sup> /day	7 hours/machine/day
Working days/year	200 days	22 days/month × 9 months
Estimated period of the construction work	3 years	After delivery of the construction machines
Estimated amount of work-volume (2)	60,750 m <sup>3</sup>	Estimated work-volume of excavation
Work period	3 years	
Required working days to complete the work (3)	600 days	
Required earthwork-volume/day (4) = (2) ÷ (3)	101 m <sup>3</sup> /day	
Required number of machines = (4) ÷ (1)	5 units	4.82 units

4. Road Stabilizer (estimated quantity: 1 unit)

Basis of Calculation	Numerical Value	Remarks
Milling/Mixing capacity/machine/h	2,400 m <sup>2</sup> /h	20m/min. x 2m x 60min. (average)
Quantity of work/machine/day (1)	9,600 m <sup>2</sup> /day	4 hours/machine/day
Working days/year	70 days	estimated period of use (average)
Estimated period of the construction work	3 years	After delivery of the construction machines
Estimated amount of work-area (2)	1,890,000 m <sup>2</sup> /h	Estimated work-volume of excavation
Work period	3 years	
Required working days to complete the work (3)	210 days	
Required earthwork-area/day (4) = (2) ÷ (3)	9,000 m <sup>2</sup> /day	(7m width x 1,286m)
Required number of machines = (4) ÷ (1)	1 unit	0.94 units

5. Sheep Foot Compactor (estimated quantity: 5 units)

Basis of Calculation	Numerical Value	Remarks
Quantity of work/machine/h	405 m <sup>2</sup> /h	
Quantity of work/machine/day (1)	2,025 m <sup>2</sup> /day	5 hours/machine/day
Working days/year	150 days	9 months
Estimated period of the construction work	3 years	After delivery of the construction machines
Estimated amount of work-area (2)	4,252,500 m <sup>2</sup>	Estimated compaction work-area,
Work period	3 years	
Required working days to complete the work (3)	450 days	
Required work-area/day (4) = (2) ÷ (3)	9,450 m <sup>2</sup> /day	
Required number of machines = (4) ÷ (1)	5 units	4.67 units

6. Vibratory Tandem Roller (estimated quantity: 5 unit)

Basis of Calculation	Numerical Value	Remarks
Quantity of work/machine/h	275 m <sup>2</sup> /h	
Quantity of work/machine/day (1)	1,650 m <sup>2</sup> /day	6 hours/machine/day
Working days/year	200 days	9 months
Estimated period of the construction work	3 years	After delivery of the construction machines
Estimated amount of work-area (2)	4,725,000 m <sup>2</sup>	Estimated work-area
Work period	3 years	
Required working days to complete the work (3)	600 days	
Required work-area/day (4) = (2) ÷ (3)	7,875 m <sup>2</sup> /day	
Required number of machines = (4) ÷ (1)	5 units	4.77 units

7. Tire Roller (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
Quantity of work/machine/h	450 m <sup>2</sup> /h	
Quantity of work/machine/day (1)	2,700 m <sup>2</sup> /day	6 hours/machine/day
Working days/year	200 days	9 months
Estimated period of the construction work	3 years	After delivery of the construction machines
Estimated amount of work-area (2)	4,725,000 m <sup>2</sup>	Estimated work-area
Work period	3 years	
Required working days to complete the work (3)	600 days	Effective working days
Required work-area/day (4) = (2) ÷ (3)	7,875 m <sup>2</sup> /day	
Required number of machines = (4) ÷ (1)	3 units	2.92 units

8. Water Truck (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
Work with Tire Roller for cooling paving work.	3 units	Same number as tire roller
Required number of machines	3 units	

9. Dump Truck (estimated quantity: 10 units)

Basis of Calculation	Numerical Value	Remarks
Hauling distance	25 km	An average distance for a round trip, between construction site and asphalt plant
Traveling (driving) speed	15 km/h	
Hauling capacity/machine/h	5 m <sup>3</sup> /h	
Hauling capacity/machine/day (1)	24 m <sup>3</sup> /day	5 hours/machine/day
Working days/year	200 days	22 days/month × 9 months
Estimated period of the construction work	3 years	
Estimated amount of work-volume (2)	132,300 m <sup>3</sup>	
Work period	3 years	
Required working days to complete the work (3)	600 days	
Required hauling-volume/day (4) = (2) ÷ (3)	221 m <sup>3</sup>	
Required number of machines = (4) ÷ (1)	10 units	9.1 units



10. Cab-back Crane (3t), 11. Cab-back Crane (8t) (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
This equipment to be deployed to Equipment Supply, Administration and Maintenance Directorate, Own Force Maintenance Directorate, and Own Force Construction Directorate, one (1) unit each	—	
Equipment Supply, Administration and Maintenance Directorate (with 8t crane)	1 unit	To transport the Container Workshop
Own Force Maintenance Directorate (with 3t crane)	1 unit	To transport the construction materials
Own Force Construction Directorate (with 3t crane)	1 unit	To transport the construction materials
Required number of machines	3 units	

12. Aerial Work Platform Vehicle (estimated quantity: 4 units)

Basis of Calculation	Numerical Value	Remarks
The quantity of equipment to be determined according to the amount of maintenance work for auxiliary facility of the road.		
Working days/year (1)	140 days	9 months
Total length of road and street (2)	3,500 km	
Estimated number of street lamps (installation interval: 100m)	34,999 num.	
Distance to be inspected/maintained /day (3) = (2) ÷(1)	25 km/day	
Number of street lamps to be inspected/maintained (installation interval: 100m)	249 num.	
Estimated period of time to inspect/maintain one street lamp	40 min.	
Number of street lamps can be inspected/maintained by a machine/day(4)	12	8 hrs./day
Required number of machines(5)	4 units	
Number of street lamps can be inspected/maintained /day (6) = (4) ×(5)	48 num.	

13. High-pressure Drainage Cleaning Vehicle (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
The quantity of equipment to be determined according to the amount of maintenance work for drain ping/drain ditch		Cleaning drain ping/drain ditch
Working days/year	140 days	9 months
Total length of road and street	540 km	
Required number of machines	3 units	

14. Vacuum Tank Truck (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
The quantity of equipment to be determined according to the amount of maintenance work for drain ping/drain ditch		Cleaning drain ping/drain ditch
Working days/year	140 days	9 months
Total length of road and street	540 km	
Required number of machines	3 units	

15. Bitumen Distributor (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
Quantity of work/machine/h	1,620 m <sup>2</sup> /h	
Quantity of work/machine/day (1)	3,240 m <sup>2</sup> /day	2 hours/machine/day
Working days/year	150 days	9 months
Estimated period of the construction work	3 years	After delivery of the construction machines
Estimated amount of work-area (2)	3,780,000 m <sup>2</sup>	Estimated work-area, after delivery of the construction machines
Work period	3 years	
Required working days to complete the work (3)	450 days	Effective working days
Required work-area/day (4) = (2) ÷ (3)	8,400 m <sup>2</sup> /day	
Required number of machines = (4) ÷ (1)	3 units	2.59 units

16. Asphalt Burner (estimated quantity: 5 units)

Basis of Calculation	Numerical Value	Remarks
This equipment to be distributed to five stations of the Own Force Maintenance Directorate and the Own Force Construction Directorate	—	
Maintenance Base Lot 1	1 unit	
Maintenance Base Lot 2	1 unit	
Construction Base Lot 1	1 unit	
Construction Base Lot 2	1 unit	
Construction Base Lot 3	1 unit	
Required number of machines	5 units	

17. Asphalt Cutter (estimated quantity: 5 units)

Basis of Calculation	Numerical Value	Remarks
This equipment to be distributed to five stations of the Own Force Maintenance Directorate and the Own Force Construction Directorate	—	
Maintenance Base Lot 1	1 unit	
Maintenance Base Lot 2	1 unit	
Construction Base Lot 1	1 unit	
Construction Base Lot 2	1 unit	
Construction Base Lot 3	1 unit	
Required number of machines	5 units	

18. Asphalt Crack Sealer (estimated quantity: 5 units)

Basis of Calculation	Numerical Value	Remarks
This equipment to be distributed to five stations of the Own Force Maintenance Directorate and the Own Force Construction Directorate	—	
Maintenance Base Lot 1	1 unit	
Maintenance Base Lot 2	1 unit	
Construction Base Lot 1	1 unit	
Construction Base Lot 2	1 unit	
Construction Base Lot 3	1 unit	
Required number of machines	5 units	

19. Air Compressor (estimated quantity: 4 units)

Basis of Calculation	Numerical Value	Remarks
This equipment to be distributed to two stations of the Own Force Maintenance Directorate and the Own Force Construction Directorate	—	
Maintenance Base Lot 2	2 units	
Construction Base Lot 1	2 units	
Required number of machines	4 units	

20. Air Breaker (estimated quantity: 5 units)

Basis of Calculation	Numerical Value	Remarks
This equipment to be distributed to two stations of the Own Force Maintenance Directorate and the Own Force Construction Directorate	—	
Maintenance Base Lot 2	3 units	
Construction Base Lot 1	2 units	
Required number of machines	5 units	

21. Portable Mini Asphalt Mixer (estimated quantity: 3 units)

Basis of Calculation	Numerical Value	Remarks
This equipment to be distributed to Vehicles and Construction Machinery Administration and Maintenance Center and two stations of the Own Force Maintenance Directorate	—	
Vehicles and Construction Machinery Administration and Maintenance Center	1 unit	
Maintenance Base Lot 1	1 unit	
Maintenance Base Lot 2	1 unit	
Required number of machines	3 units	

22. Asphalt Plant (estimated quantity: 1 unit)

Basis of Calculation	Numerical Value	Remarks
Quantity of production/machine/h	80 ton/h	Asphalt mixture production
Quantity of production/machine/day (1)	560 ton/day	7 hours/machine/day
Working days/year	200 days/year	9 months
Estimated period of work	3 years	After delivery of the construction machines
Estimated amount of production to make up for shortage (2)	310,905 ton	110,000 ton/year × 3 years
Work period	3 years	
Required working days to complete the work (3)	600 days	
Required production capacity/day (4) = (2) ÷ (3)	518 ton/day	
Required number of machines = (4) ÷ (1)	1 unit	0.93 units

23. Mobile Workshop (estimated quantity: 1 unit)

Basis of Calculation	Numerical Value	Remarks
This equipment to be deployed to Equipment Supply, Administration and Maintenance Directorate.	1 unit	Carrying out repair and maintenance works for the road construction equipment at the construction site
Required number of machines	1 unit	

24. Container Workshop (estimated quantity: 1 unit)

Basis of Calculation	Numerical Value	Remarks
This equipment to be deployed to Equipment Supply, Administration and Maintenance Directorate, for storing and managing workshop tools and equipment to be procured.	1 unit	Storing and managing workshop tools and equipment to be procured.
Required number of machines	1 unit	

Source: Prepared by the Survey Team

### 2-2-3 Outline Design Drawings

Reference drawings of the road maintenance equipment of the Project are shown in Table 2-2.17.

Table 2-2.17 Reference Drawings of Road Maintenance Equipment

1. Wheel Loader	2. Backhoe Loader
	
3. Excavator	4. Road Stabilizer
	
5. Sheep Foot Compactor	6. Vibratory Tandem Roller
	
7. Tire Roller	8. Water Truck
	
9. Dump Truck	10. 11. Cab-back Crane (3t, 8t)
	

12. Aerial Work Platform Vehicle	13. High-pressure Drainage Cleaning Vehicle
 <p>A white truck with a blue aerial work platform mounted on the back. The platform is extended upwards and outwards.</p>	 <p>A blue truck with a large cylindrical tank and a high-pressure hose reel mounted on the back. It has a red and yellow striped bumper.</p>
14. Vacuum Tank Truck	15. Bitumen Distributor
 <p>A blue truck with a large vacuum tank and a hose reel mounted on the back. It has a red and yellow striped bumper.</p>	 <p>A green truck with a large cylindrical tank and a distributor system mounted on the back. It has a red and white striped bumper.</p>
16. Asphalt Burner	17. Asphalt Cutter
 <p>A small, portable asphalt burner with a propane tank and a hose.</p>	 <p>A small, portable asphalt cutter with a circular cutting wheel and a handle.</p>
18. Asphalt Crack Sealer	19. Air Compressor
 <p>A portable asphalt crack sealer with a tank and a hose.</p>	 <p>A large, portable air compressor with a tank and a hose.</p>
20. Air Breaker	21. Asphalt Mixer
 <p>A red air breaker with a long handle and a pointed tip.</p>	 <p>A yellow asphalt mixer with a large hopper and a mixing drum.</p>

22. Asphalt Plant



23. Mobile Workshop








Source: Prepared by the Survey Team

Reference drawings of the workshop equipment of the Project are shown in Table 2-2.18.

Table 2-2.18 Reference Drawings of Workshop Equipment

<p>1. Container Workshop</p> 	<p>2. Tire Changer</p> 
<p>3. Portable Gantry Crane</p> 	<p>4. Wheel Dolly</p> 
<p>5. High Pressure Washer</p> 	<p>6. Engine Hot Water High Pressure Washer</p> 

7. Engine Driven Welding Generator	8. AC Arc Welder
	
9. Portable Motor Driven Air Compressor	10. Parts Washing Stand
	
11. Jacks	-
	-

Source: Prepared by the Survey Team

## **2-2-4 Implementation Plan**

### **2-2-4-1 Implementation Policy**

The Project will be implemented based on the Government of Japan's Grant Aid Scheme. According to this scheme, the Project will be approved by the Government of Japan, and then the two countries' governments will sign the Exchange of Notes (E/N) and the Grant Agreement (G/A). Then, a Japanese Consultant, recommended by JICA will sign a contract with the executing agency of Ethiopia for the tendering and supervision of the equipment procurement. The Consultant will supervise the main work components to ensure that the Project is executed smoothly and appropriately. The basic items and points that require particular consideration in the event of the Project implementation are indicated below.

#### **(1) Project Implementing Entities**

The responsible and supervisory agency on the Ethiopian side will be Addis Ababa City and executing agency is AACRA. Also, following the handover of the equipment, executing agency will be in charge of the appropriate operation and maintenance of the equipment.

#### **(2) Consultant**

In order to supervise the preparation of the tender specifications and the procurement and installation of the equipment of the Project, the Ethiopian side will sign a consultant supervision agreement with the Consultant recommended by JICA. Moreover, the Consultant will implement the soft component in order to ensure the appropriate operation and maintenance of the equipment and strengthen the spare parts management, and to improve the construction capacity by using the equipment to be procured in the Project.

#### **(3) Supplier**

In accordance with the framework of Japan's Grant Aid Scheme, a supplier selected through a competitive tendering process will implement the procurement, transportation, on-site assembly, initial operation training of the equipment to be procured in the Project.

Since it will be necessary to continue supplying spare parts and conducting post-installation services after the completion of the Project, the supplier needs to establish close liaison and coordination after the handover of the equipment.

### **2-2-4-2 Implementation Conditions**

#### **(1) Suppliers**

Since the equipment to be procured in the Project is not manufactured or produced in Ethiopia, equipment made by Japanese manufacturers will be selected. However, since some of the Japanese equipment manufacturers have suspended domestic manufacturing and transferred their production and manufacturing bases to overseas plants, equipment produced by such overseas plants may also be procured. Furthermore, products from third countries may be selected as needed from the viewpoint of securing bid competitiveness.



## (2) Construction and Implementation Planning Conditions

- When equipment to be procured is transported inland, it may extend beyond the body of the transporting vehicle in some cases. Also, the roads in Addis Ababa City are very congested, and it is important to take safety precautions such as guiding the traffic coming from the opposite direction and that of the same direction when transporting large equipment.
- After unloading the equipment at the Djibouti Port, National Road 1 of Djibouti will be used to transport the equipment to Ethiopia. However, National Road 1 is blocked several times a year by earth and sand deposits on the ford of seasonal river (wadi) when it rains. Thus, it is important to take necessary precautions such as assessing the ford in advance, particularly in rainy season.

### 2-2-4-3 Scope of Works

Table 2-2.19 shows the detailed scope of works on the Japanese and Ethiopian sides.

Table 2-2.19 Scope of Works

No.	Item	Scope		Remarks
		Japan	Ethiopia	
1	Securing of storage area for the equipment and spare parts		○	
2	Securing of site office		○	As the need arises
3	Manufacturing and procurement of the equipment to be procured in the Project	○		
4	Inland transportation of the equipment to be procured in the Project	○		Between a manufacturer's factory and a port in Japan
5	Marine transportation, customs clearance and handling of taxes	-	-	
	(1) Responsibility for marine/air transportation of the equipment to be procured in the Project to Ethiopia	○		
	(2) Tax exemption and customs clearance at the port of disembarkation		○	
	(3) Inland transportation of the equipment to be procured in the Project from the port of disembarkation to the delivery point	○		
6	Appropriate operation and management of the equipment to be procured in the Project and spare parts		○	
7	Procedures and measures necessary for acquiring the following permits: Registration of equipment <ul style="list-style-type: none"> <li>■ Registration of equipment</li> <li>■ Permits necessary for the passage of heavy vehicles</li> <li>■ Permission for access to restricted areas</li> <li>■ Permission for entry of Japanese nationals</li> </ul>		○	
8	Assembly and adjustment of the equipment to be procured in the Project	○		
9	Handover inspection, initial operation training for the equipment to be procured in the Project	○		The Ethiopian side will secure and assign the personnel to participate in this training and guidance.
10	Securing personnel such as equipment operators and their allocation to initial operation training		○	

No.	Item	Scope		Remarks
		Japan	Ethiopia	
11	Preparation for the operation guidance about Road Stabilizer (pilot construction, mix design test) and restoration of asphalt pavement after the operation guidance		○	The Ethiopian side bears the expense of materials related to pilot construction and the expense of the test related to the mix design test under the operation guidance. In addition, the Ethiopian side will secure and assign the personnel to participate in this training and guidance.
12	Dispatching trainers for soft component	○		
13	Deployment of trainees for soft component		○	
14	Implementation of works for maintenance of the target roads		○	
15	Bearing all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		○	
16	Bearing the following commissions paid to the Japanese bank for banking services based upon the Banking Arrangement (B/A): <ul style="list-style-type: none"> <li>■ Cost of opening an account in a Japanese certified foreign exchange bank</li> <li>■ Payment commission</li> </ul>		○	

Note) “○” Indicates the responsible side for each item

Source: Prepared by the Survey Team

#### 2-2-4-4 Consultant Supervision

Based on the Government of Japan’s Grant Aid Scheme, the Ethiopian side will sign an agreement with the Consultant recommended by JICA for consulting service and strive to ensure the smooth implementation of a detailed design and procurement supervision.

Moreover, where necessary, the Consultant will dispatch specialist engineers to witness the factory inspections and pre-shipment inspections of the equipment to be procured in the Project, and conduct supervision to prevent the occurrence of troubles after the equipment has been brought onto sites.

##### (1) Basic Policy of Consultant Supervision

As the basic policy of the supervision, the Consultant will supervise the progress of the overall plan to ensure on-schedule completion of the Project finishes, and it will supervise and provide guidance to the procurement agent in cooperation with the Ethiopian side to ensure that the quality specified in the contract is secured and the Project is safely implemented.

The major points to bear in mind in the procurement supervision are described below.

##### 1) Schedule Control

The Consultant will compare the progress with the implementation schedule in the contract every month or every week in order to adhere to the delivery deadline given in the contract. In cases where delays are predicted, the Consultant will warn the Supplier(s), demand the submission and implementation of countermeasures, and offer guidance to ensure the Project is finished on schedule.

The Consultant will carry out the following tasks:

- Confirmation of work performance in manufacturing and procurement of the equipment to be procured
- Confirmation of shipping arrangement and inland transportation methods for transporting the equipment to be procured
- Confirmation of the assignment of personnel concerned with assembly of the equipment to be procured and the initial operation training, etc.

## 2) Quality Control

The Consultant will confirm whether the quality of the equipment to be procured meets the one stated in the contract documents (technical specifications, approved design drawings, etc.) based on the following items:

- Checking shop drawings and specifications of the equipment to be procured
- Attending factory inspections of the equipment to be procured , or checking factory inspection results
- Checking guidelines for trial operation, adjustment and inspection
- Supervising the site assembly of the equipment to be procured and witnessing trial operation, adjustment and inspection.

In cases where doubts arise over quality, the Consultant will demand that the Supplier(s) make amendments, revisions or corrections.

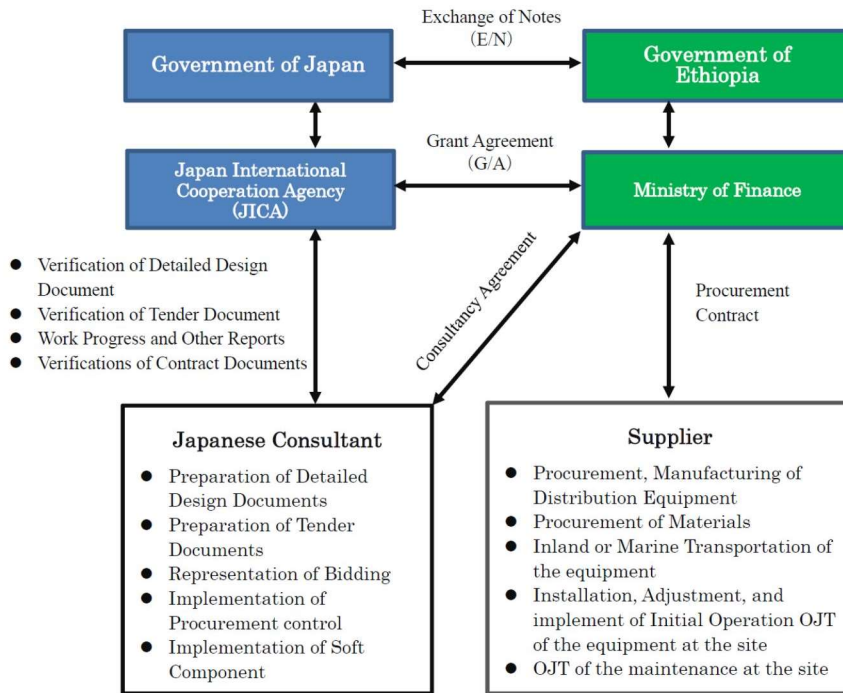
## 3) Safety Control

Discussions will be held and cooperation will be sought with the Supplier(s) and supervision will be conducted during the Project implementation period in order to prevent the occurrence of industrial accidents or other incidents. Important points to consider in safety control on the ground are as follows:

- Establishment of safety control rules and appointment of a safety manager
- Prevention of accidents through inspection of safety devices such as work tools and equipment
- Preparation of plans for inland transportation routes, enforcement of slow driving and prevention of load collapse
- Wearing of safety gear (helmets, safety shoes, gloves, etc.)

## **(2) Overall Relationships for Project Implementation**

Figure 2-2.6 shows the relationships between the Project implementing parties including the consultant supervision.



Source: Prepared by the Survey Team

Figure 2-2.6 Project Implementation Relationships

### (3) Procurement supervisor

The Supplier(s) will procure and assemble the equipment and implement the initial operational training based on the contract with the Ethiopian side. It will also conduct schedule control, quality control and safety control during the work, although the Consultant's procurement supervisor will instruct and supervise the Supplier(s).

#### 2-2-4-5 Quality Control Plan

The Consultant will confirm whether the quality of the Project equipment is according to the contract documents (technical specifications, approved design drawings, etc.) based on the following items:

- Checking shop drawings and specifications of the Project equipment
- Attending factory inspections of the Project equipment, or checking factory inspection results
- Checking the packing, transportation and temporary storage methods on site
- Checking guidelines for trial operation, adjustment and inspection
- Supervising the site assembly of the Project equipment and witnessing trial operation, adjustment and inspection

In cases where doubts arise over quality, the Consultant will demand that the Supplier(s) make amendments, revisions or corrections.

#### 2-2-4-6 Procurement Plan

Since the equipment planned to be procured in the Project is not manufactured or produced in Ethiopia, the equipment made by Japanese manufacturers will be basically selected. The equipment to be procured in the Project includes ①the equipment produced by Japanese manufacturers in Japan, ②

the equipment that Japanese manufacturers have stopped producing in Japan and are producing at overseas plants, ③the equipment produced by overseas manufacturers (third-country products) . To ensure bidding competitiveness, the equipment that is not produced by Japanese manufacturers or the equipment that is produced by only one Japanese manufacturer is included in third-country products.

Table 2-2.20 shows the procurement by country.

Table 2-2.20 Country of Origin

No.	Equipment	Country of Origin		
		Japan	Ethiopia	Third Countries
1	Wheel Loader	○		Brazil
2	Backhoe Loader			Italy, UK
3	Excavator	○		USA
4	Road Stabilizer	○		Germany
5	Sheep Foot Compactor	○		Germany
6	Vibratory Tandem Roller	○		Germany
7	Tire Roller	○		Germany
8	Water Truck	○		
9	Dump Truck	○		
10	Cab-back Crane (3t)	○		
11	Cab-back Crane (8t)	○		
12	Aerial Work Platform Vehicle	○		
13	High-pressure Drainage Cleaning Vehicle	○		
14	Vacuum Tank Truck	○		
15	Bitumen Distributor	○		
16	Asphalt Burner	○		
17	Asphalt Cutter	○		
18	Asphalt Crack Sealer	○		
19	Portable Air Compressor	○		
20	Air Breaker	○		
21	Asphalt Mixer			UK
22	Asphalt Plant	○		
23	Mobile Workshop	○		
24	Container Workshop	○		
25	Tire Changer	○		
26	Portable Gantry Crane	○		
27	Wheel Dolly	○		
28	High Pressure Washer	○		
29	Engine Hot Water High Pressure Washer	○		
30	Engine Driven Welding Generator	○		
31	AC Arc Welder	○		
32	Portable Motor Driven Air Compressor	○		
33	Parts Washing Stand	○		
34	Jacks	○		
35	Desktop Computer		○	
36	Database Software	○		

Source: Prepared by the Survey Team

Irrespective of the country of procurement, all the procured equipment will have the Government of Japan ODA symbol applied either by paint or by sticker.

#### **2-2-4-7 Operational Guidance Plan**

Initial operation training of the Project equipment will be conducted as OJT by instructors from manufacturers according to the operation and maintenance manuals when handing over the equipment. In order to smoothly implement this guidance plan, AACRA will need to establish close liaison and hold discussions with the Consultant and equipment procurement agent, and appoint specialist engineers to participate in the OJT. The appointed AACRA engineers will need to share the training with their colleagues who could not participate in the Project, and thereby contribute to the improvement of the maintenance capability of AACRA. Moreover, since expert engineers from manufacturers who possess required expertise have to operate and adjust the equipment to be procured, it will be difficult to utilize local firms for this purpose, and it will be necessary to dispatch engineers.

In addition, operation guidance in the Project will be implemented for Road Stabilizer. This equipment is the equipment that mixes cement, lime and bituminous material with the existing roadbed to increase its strength. To start appropriate operation of Road Stabilizer, instruction on how to conduct a mix design test of the current roadbed material and additives, and instruction on on-site construction are necessary (some expenses will be borne by the Ethiopian side). In addition, the technical manual on construction method using Road Stabilizer will be summarized and provided.

#### **2-2-4-8 Soft Component (Technical Assistance) Plan**

##### **(1) Background of the Soft Component**

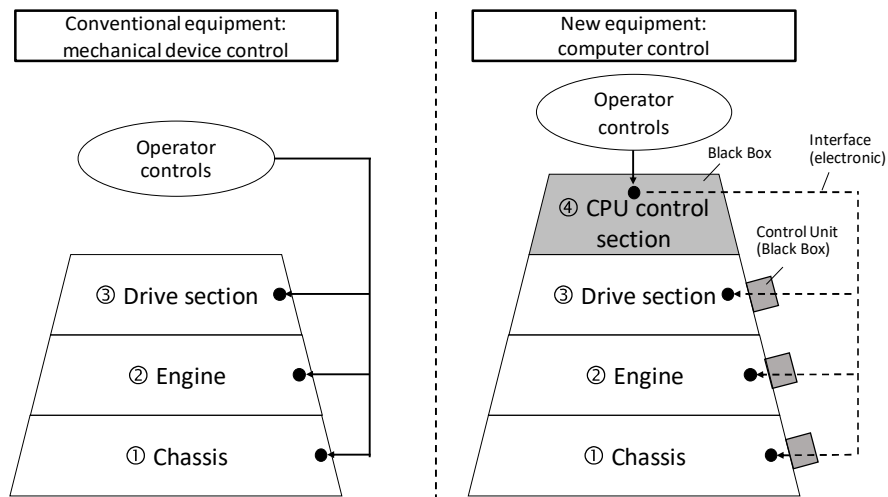
The soft component in the Project are aimed at ① Improvement of the equipment management system and ② Strengthening of equipment servicing and private sector utilization capacity, based on the equipment procurement of the Project. The background for performing the soft component are described below.

##### **1) Trends Surrounding the Public Construction Equipment Sector**

In Japan, due to the downsizing of the investment in public works in 1980s, the construction operators faced difficulties in securing parking spaces for their own construction equipment, keeping maintenance facilities, sustaining the operating rates of the equipment and so on, leading towards reviewing the cost and efficiency of equipment operation and maintenance. As a result, construction equipment service providers (construction equipment leasing companies) possessing equipment repair and maintenance facilities (workshops) and service personnel gradually spread. From the 1990s to 2000s, in line with the increase of the private sector, the private sector leasing and selling construction equipment to the construction firms increased commensurate with the domestic demand and this model has matured to the level it is today.

Moreover, in recent years, the latest construction equipment produced by manufacturers in Japan, Europe and America is witnessing technical innovation aiming at ① enhancement of mechanical performance and quality, ② reduction of manufacturing and maintenance costs, ③ greater efficiency of repair services, etc. when breakdowns occur, and so on. In Japan, especially, from around

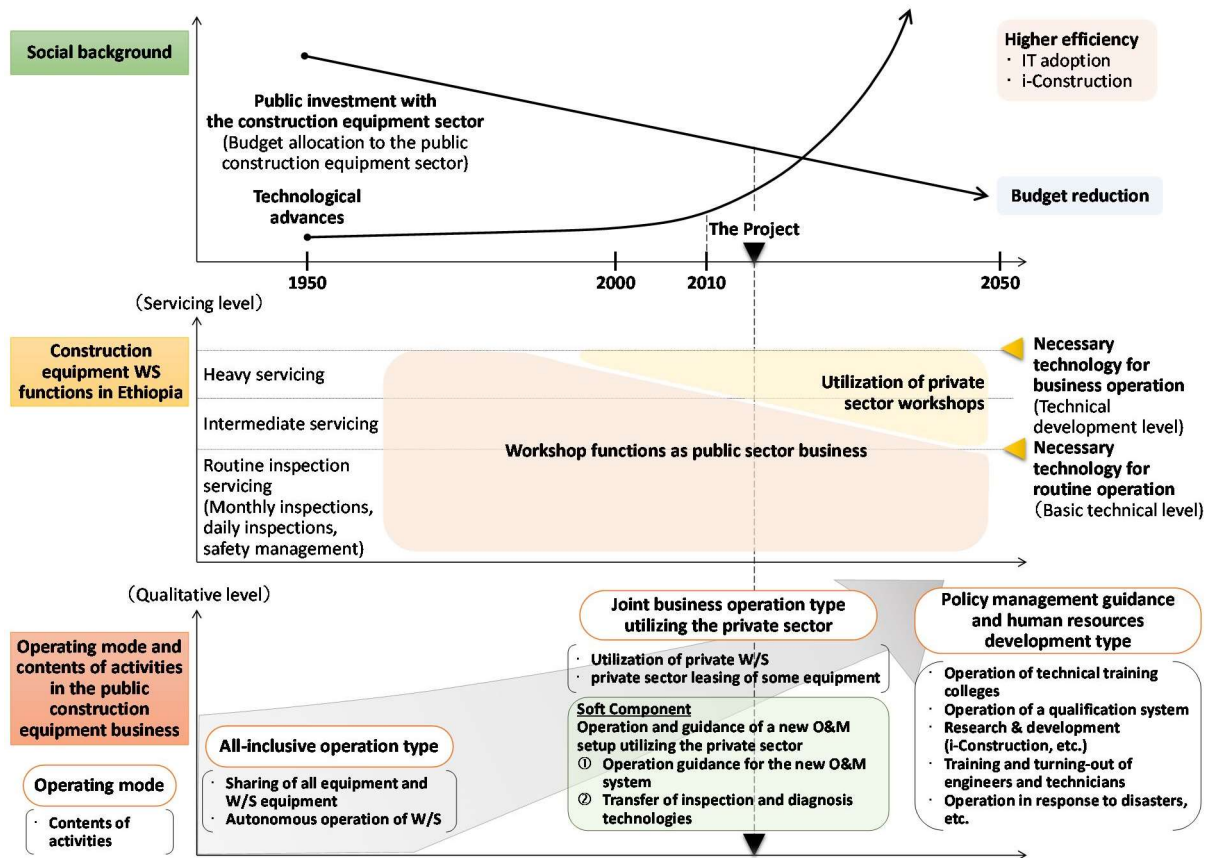
2010, utilization of digital technology has become conspicuous in the construction equipment sector, resulting in a transition to computer-controlled systems that enable automation, labor saving, and higher performance compared to the conventional equipment and devices (see Figure 2-2.7). In line with such advances in computer-control technology, the internal structures and operating principles of equipment and equipment have tended to become so complex that only the manufacturers and their agents can understand them, i.e. the technology is increasingly becoming a black box. Accordingly, in Japan and Western countries, medium- and large-scale repairs and maintenance exceeding the level of routine repairs and maintenance are being switched to systems that utilize maintenance services based on the specialized technologies of manufacturers and their agents.



Source: Prepared by the Survey Team

Figure 2-2.7 Transitions in Equipment Control System

Based on the conditions described above in the public construction equipment sector, Figure 2-2.8 shows the scope of construction equipment workshop services that should be entrusted to the private sector, and the model for the development of the sector corresponding to the changing operating mode of the public construction equipment sector. Due to changes in the mode of service and latest technologies in the construction equipment sector, construction firms (construction equipment users) have departed from the system of autonomously implementing equipment repairs and maintenance. A system of division of labor has been established between construction firms, construction equipment leasing companies, and equipment manufacturers and agents for operating and managing construction equipment over the course of its service life. Moreover, Western nations and, more recently, countries following their lead, are replicating the Japanese model as they promote innovation of equipment and technology and seek greater efficiency. Moreover, it is expected that a similar trend will also be seen in developing countries in the future.



Source: Prepared by the Survey Team

Figure 2-2.8 Development Model for the Public Construction Equipment Sector

Considering this trend, the private construction equipment firms in Ethiopia, too, is expected to develop from now on. As a result, the roles of the private sector and public sector will be clarified, with AACRA, in its capacity as road manager and ordering client, switching to a setup fostering and guiding the private sector. However, considering the degree of private sector development and technological levels of the construction and construction equipment sector in Ethiopia, the country is expected to go through a transitional phase and may require between 10 years and a few decades to achieve the level of business operation based on private sector that is seen in the developed countries.

## 2) Current Conditions and Issues in Equipment Operation and Maintenance

AACRA, the executing agency for the Project, owns around 580 units of road maintenance equipment, which it uses for the maintenance of the roads and highways under its jurisdiction. The existing equipment currently owned by AACRA is centrally managed by the Vehicles and Construction Equipment Administration and Maintenance Center (hereinafter referred to as the Equipment Management Center) under the Equipment Supply, Administration and Maintenance Directorate, which is in charge of AACRA's equipment operation and maintenance. The Equipment Management Center is in charge of allocating equipment for the road repairs and maintenance implemented by AACRA, procuring equipment and spare parts, maintaining the equipment and so on, and the Center's facilities include a workshop for equipment repairs and maintenance. The repair and maintenance works carried out by the Equipment Management Center extends from periodic servicing, inspections,



adjustments and light repairs and maintenance corresponding to the workshop's equipment and technical level, to equipment repair and maintenance by mechanics with a certain degree of technical skill. For medium- or large-scale repairs and maintenance works that are beyond the technical capacity of the mechanics, AACRA consigns repairs and maintenance to private sector equipment service providers (manufacturer's agents) situated in Addis Ababa City. Table 2-2.21 shows the current division of services between AACRA and private sector operators according to the level of equipment repair and maintenance.

Table 2-2.21 Current Division of Equipment Repair and Maintenance between AACRA and Private Sector Operators

Service level	Type of equipment servicing and repair	Main work items	Implementation division		
			AACRA		Private sector
			Central	Local base	
1 <b>Light</b>	Periodic servicing	Oil change, lubrication, etc.	○	○	
2	Inspections and adjustments	Brake adjustment, tire adjustment, etc.	○	○	
3	Light servicing and repair	Clutch overhaul, parts replacement, etc.	○		
4	Complete disassembly and repair of major equipment	Engines, transmissions, etc.	○		○ (Targeting precision parts)
5 <b>Heavy</b>	Inspection, diagnosis, repair of breakdowns in digital devices	Engines, transmissions, hydraulic control units, etc.			○ (Inspection, diagnosis, repair)
6	Complete disassembly, repair and refitting of equipment	Heavier servicing than above			○

Source: Prepared by the Survey Team

Under such circumstances, to ensure that AACRA implements appropriate and sound operation and maintenance of the Project equipment as well as existing equipment over its service life, it will be necessary to seek actively the utilization of private sector services when necessary, while maintaining the current system of directly managing the operations. However, due to limited or lack of technical skill of AACRA mechanics, equipment operation and maintenance problems such those indicated in Table 2-2.22 have been reported recently. Therefore, it is necessary to build the capacity AACRA to address such problems and thereby enable the establishment of a robust system of work division with the private sector.

**Table 2-2.22 Reported Problems Concerning Utilization  
of the Private Sector and Their Solutions**

Reported Problems		Subsequent Problems	Solutions
Case 1	Excessive inventory of spare parts	Higher spare parts purchase costs, inefficient operation of stores	Grasp the replacement cycles of spare parts, and avoid inflated costs due to excessive purchasing.
Case 2	Inventory shortages of spare parts due to delays in purchasing	Reduced equipment operating rates and work delays due to delays in replacement of spare parts	Grasp the replacement cycles of spare parts, and implement timely and appropriate equipment servicing based on appropriate inventory management.
Case 3	Failure to share equipment operating conditions, servicing histories, etc. with managers	Delays in equipment repairs and maintenance, and work delays due to lack of unified management by the departments	Unified information sharing for equipment operation and management
Case 4	Acceptance of excessive repairs not commensurate with the level of breakdown	Increase in unnecessary repair costs	Acquire basic knowledge related to equipment diagnosis, and determine appropriate repair contents based on the results of diagnosis. Implement safe and appropriate repair and maintenance work making use of workshop equipment when independently conducting repairs.

Source: Prepared by the Survey Team

To resolve the issues described in Table 2-2.22, the following measures need to be supported: ① enhancement of appropriate equipment repairs and maintenance and spare parts management corresponding to equipment operation records, ② building the equipment management information communication system for sharing equipment operation and management information, ③ enhancement of the capacity for determining appropriate repair contents based on equipment fault diagnosis, and ④ building the capacity for safe and accurate equipment repair and maintenance.

### 3) Basic Policy of the Project's Soft Component

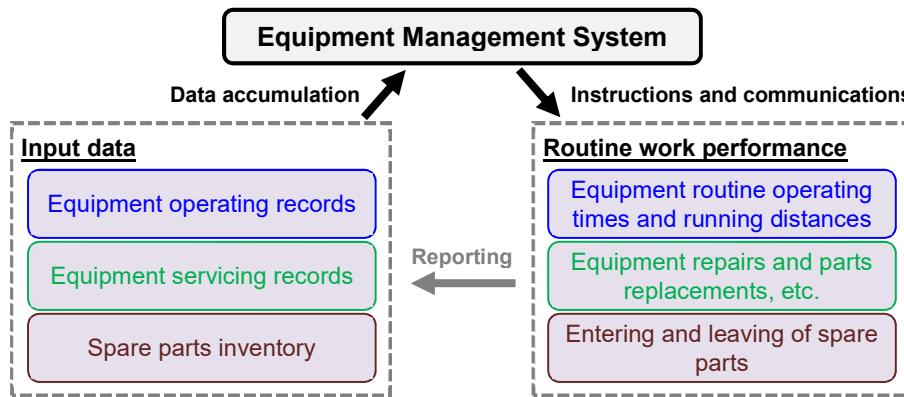
Table 2-2.23 shows the implementation contents of the soft component in the Project in light of solving the issues described above.

**Table 2-2.23 Support for Construction of the Equipment Operation  
and Maintenance Setup based on the Soft Component**

Item	Outline of activities	Remarks
(1) Improvement of the equipment management system	Support for introduction and operation of a computer-based equipment management system and building of the equipment management information communication system utilizing mobile devices.	Corresponding to issues for resolution under Cases 1, 2 and 3 in Table 2-2.22
(2) Strengthening of equipment servicing and private sector utilization capacity	Enhancement of AACRA's repair technology and capacity for utilizing private sector repair and maintenance services through acquisition of diagnosis technology utilizing trouble diagnosis device and stocking of know-how.	Corresponding to issues for resolution under Case 4 in Table 2-2.22

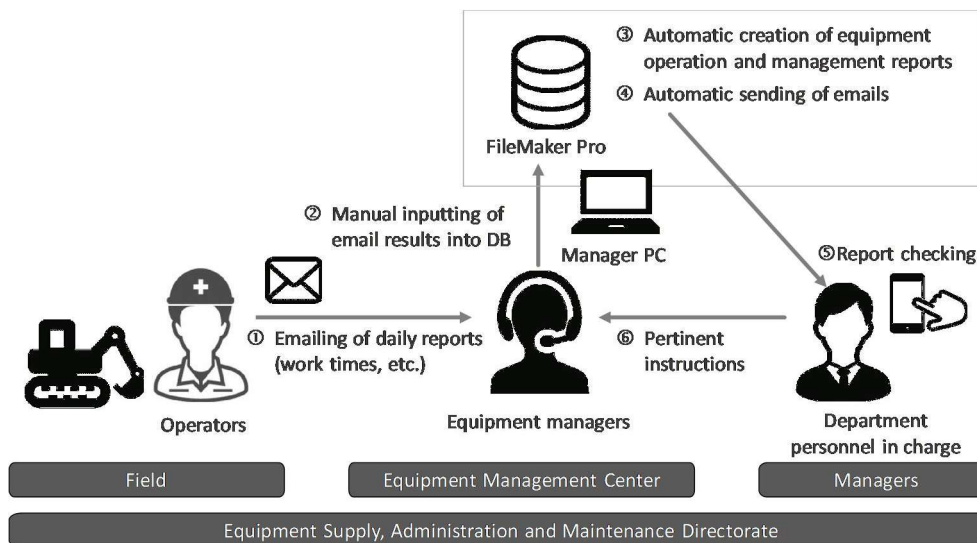
Source: Prepared by the Survey Team

Figure 2-2.9 shows the operating cycle of the equipment management system that is supported the introduction in the soft component. Figure 2-2.10 shows the flow of the equipment management information communication system. The equipment management information communication system is a system that automatically distributes various stored data that are transmitted from a field operator by a mobile devices and stored in the equipment management system by equipment managers to the manager levels (departmental responsible personnel).



Source: Prepared by the Survey Team

Figure 2-2.9 Operating Cycle of the Equipment Management System



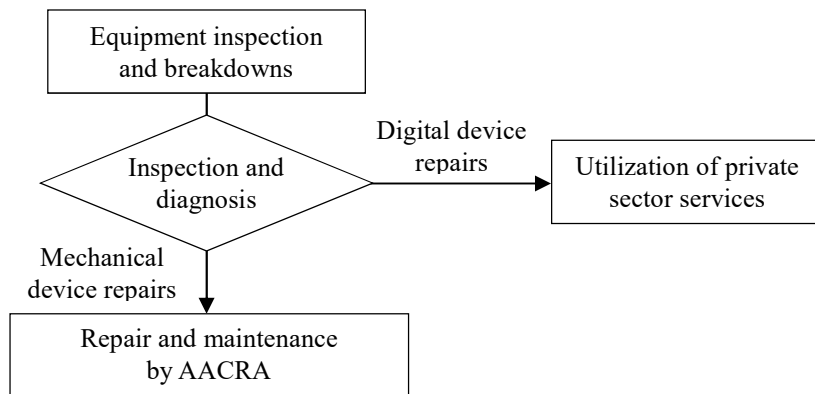
Source: Prepared by the Survey Team

Figure 2-2.10 Flow of the Equipment Management Information Communication System

Figure 2-2.11 shows the flow of the maintenance utilizing private sector. Table 2-2.24 shows the division of services between AACRA and private sector after the soft component. In other words, AACRA diagnoses repair level and accumulates know-how to judge the necessity of utilization of private sector based on the diagnosis result, through the technical support related to failure inspection of electronic devices within “maintenance level: 5” shown in Table 2-2.21. As a result, AACRA will be able to carry out sustainable utilization of private sector within an appropriate range.

The equipment including the fault diagnosis will be one Wheel Loader for earthwork construction equipment in light of efficiency of project activities. For vehicles, the fault diagnosis that can be

commonly used in vehicles will be installed in Container Workshop. Therefore, manufacturers of Wheel Loader and Container Workshop will execute basic operation guidance of the fault diagnosis device during initial operation training. On the other hands, in this soft component, training of fault diagnosis and manual preparation for the Project equipment will be carried out to acquire know-how to identify failure points and repair contents through fault diagnosis, and technology and knowledge that can be deployed to other types of earthwork construction equipment.



Source: Prepared by the Survey Team

Figure 2-2.11 Flow of Equipment Inspection and Diagnosis and Subsequent Repairs and Maintenance

Table 2-2.24 Division of Equipment Repair and Maintenance between AACRA and Private Sector Operators following the Completion of the Soft Component

Service level	Type of equipment servicing and repair	Main work items	Implementation division		
			AACRA		Private sector
			Central	Local base	
1 <b>Light</b>	Periodic servicing	Oil change, lubrication, etc.	○	○	
2	Inspections and adjustments	Brake adjustment, tire adjustment, etc.	○	○	
3	Light servicing and repair	Clutch overhaul, parts replacement, etc.	○		
4	Complete disassembly and repair of major equipment	Engines, transmissions, etc.	○		○ (Targeting precision parts)
5	Inspection, diagnosis, repair of breakdowns in mobile devices	Engines, transmissions, hydraulic control units, etc.	○ <b>(Inspection and diagnosis)</b>		○ (Repairs)
6 <b>Heavy</b>	Complete disassembly, repair and refitting of equipment	Heavier servicing than above			○

Source: Prepared by the Survey Team

Through the technical support described above, the soft component aims to build a setup for conducting appropriate operation and maintenance of the equipment in tandem with the private sector, targeting AACRA, which is currently in a state of transition regarding joint operations with the private sector. The contents of the soft component is shown in Appendix 5 “Soft Component Plan”.

## (2) Future Outlook after Soft Component

After the completion of the soft component of the Project, the internet communication environment will be further improved in Addis Ababa City and cloud service providers providing various software operation and maintenance services are expected to spread. Therefore, it may be possible to move to an operation and maintenance system that uses the cloud service of a private business operator, such as software updates and security measures of the equipment management system.

Based on the above, it is hoped that it will be transformed into a more convenient and sustainable management system with the improvement of the communication environment and the spread of private businesses in Addis Ababa City, based on the equipment management system built with the soft component.

### 2-2-4-9 Implementation Schedule

The implementation schedule for the detail design and procurement supervision to be conducted by the Japanese side is shown in Table 2-2.25.

Table 2-2.25 Implementation Schedule

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
<b>DETAIL DESIGN and TENDERING STAGE</b>	■ (Preparation of Tender Documents)																		
	■ (Obtaining of Approval for Tender Documents)																		
	■ (Tender Opening [in Japan])																		
	■ (Tender Evaluation, Concluding the Contract with the Successful Tender)																		
<b>4.0 months</b>																			
<b>PROCUREMENT SUPERVISION</b>	■ (Meeting, Preparation for Preparing Drawings, Obtaining Approval)																		
	■ (Manufacturing)																		
	■ <b>The First Shipment</b>																		
	■ <b>The Second Shipment</b>																		
	■ (Pre-shipment Inspection)																		
	■ (Transport)																		
	■ (Transport)																		
	■ (Asphalt Plant Foundation Work)																		
	■ (Loading, Assembly, Adjustment, Initial Operation Training)																		
	■ (Operation Guidance, Inspection Delivery)																		
<b>18.5 months</b>																			

Source: Prepared by the Survey Team

## 2-3 Obligations of Recipient Country

Following the conclusion of the E/N, the Ethiopian side will implement the following tasks based on the executing agency and other related agencies:

- Following the conclusion of the E/N, it will immediately open an account with a Japanese bank. Moreover, the Ethiopian side will bear any costs incurred in opening the account.

- With respect to project officials (Japanese and third country nationals), it will take steps to ensure their entry to Ethiopia, stay therein and safety.
- It will exempt or bear any tariffs and domestic taxes that would otherwise be levied on the services, equipment and materials and Japanese nationals related to the Project.
- In the case where authorization needs to be secured from government offices, it will apply for it and secure the necessary authorization.
- It will secure sites to safely store the equipment and spare parts procured in the Project and implement appropriate operation and maintenance.
- It will secure the budget, personnel and materials needed to conduct the operation guidance and the soft component.
- It will secure the budget, personnel and materials needed for the target road maintenance and promptly start the work following the handover of equipment.
- In the case where additional road area needs to be secured for maintaining the Project target roads, it will certainly secure the necessary land according to Ethiopian laws so that the works start without delay.
- It will operate and surely maintain the roads that are constructed under Japan's Grant Aid.
- It will bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.

AACRA, the executing agency, has the capacity to allocate budget and personnel to conduct road maintenance following the handover of equipment. Moreover, since it has been confirmed by site survey that the storage site for the procured equipment has already been secured, it is deemed that the Ethiopian side can fulfill its obligations.

## **2-4 Project Operation and Maintenance Plan**

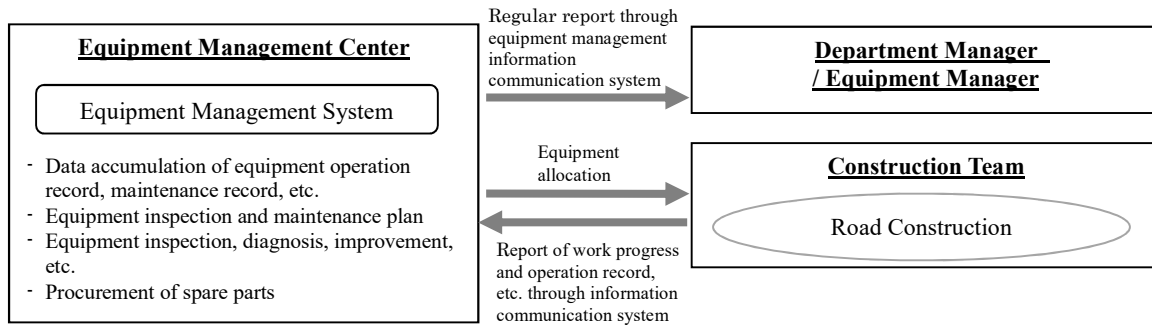
The target road maintenance is led by Own Force Maintenance Directorate and Own Force Construction Directorate, which are in charge of construction, and also Equipment Supply, Administration and Maintenance Directorate, which is in charge of equipment operation.

After the delivery of equipment, Own Force Maintenance Directorate will mainly implement maintenance of targeted road, and if necessary, equipment will be arranged to Own Force Construction Directorate. Own Force Maintenance Directorate will formulate maintenance plan according to the annual budget allocation. Road maintenance work will be promoted as 140km annually until targeted year, 2024. The senior officers of Own Force Maintenance Directorate shall timely grasp the operation records of the road maintenance equipment procured by the Project through the equipment management system and equipment management information communication system, which is built by the soft component of the Project.

The Equipment Management Center that manage the equipment owned by AACRA will be responsible for the operation and maintenance of road maintenance equipment to be procured in the Project. Employees of the Equipment Management Center who are in charge of equipment management shall collect operation records of road maintenance equipment from equipment operators and store as data through the equipment management system and the equipment management

information communication system to be introduced as a part of the soft component. The Equipment Management Center will properly understand when equipment inspection and maintenance should be performed based on the database, and will operate and maintain the equipment efficiently.

Figure 2-4.1 shows the communication and reporting structure about equipment operation and maintenance mentioned above.



Source: Prepared by the Survey Team

Figure 2-4.1 Operation and Maintenance Structure of Executing Agency

The Supplier(s) should secure an after-sales service system for all the equipment procured by the Project including the sale of spare parts after delivery of equipment by appointing a service agent in Ethiopia or neighboring countries.

AACRA requires personnel assignment according to the scale of the equipment to be procured for the proper operation and maintenance of the equipment to be procured in the Project. AACRA owns 580 units of road maintenance equipment (313 units of them are operational), and it has approx. 100 drivers and operators of the equipment including part time workers (as of April 2019). Meanwhile, the main equipment to be procured in the Project is estimated to require the workforce shown in Table 2-4.1. Thus, AACRA needs to secure drivers and operators before the delivery of equipment to be procured, and have them acquire knowledge and skills through the initial operation training and the soft component in the Project.

Table 2-4.1 Necessary Drivers and Operators

No.	Name of Equipment	Number of Equipment (e)	Personal needed (p.)
1	Wheel Loader	3	3
2	Backhoe Loader	7	7
3	Excavator	5	5
4	Road Stabilizer	1	1
5	Sheep Foot Compactor	5	5
6	Vibratory Tandem Roller	5	5
7	Tire Roller	3	3
8	Water Truck	3	3
9	Dump Truck	10	10
10	Cab-back Crane (3t)	2	2
11	Cab-back Crane (8t)	1	1
12	Aerial Work Platform Vehicle	4	4
13	High-pressure Drainage Cleaning Vehicle	3	3

No.	Name of Equipment	Number of Equipment (e)	Personal needed (p.)
14	Vacuum Tank Truck	3	3
15	Bitumen Distributor	3	3
16	Asphalt Burner	5	-
17	Asphalt Cutter	5	-
18	Asphalt Crack Sealer	5	-
19	Air Compressor	4	-
20	Air Breaker	5	-
21	Asphalt Mixer	3	3
22	Asphalt Plant	1	5
23	Mobile Workshop	1	1
		Total	67

Source: Prepared by the Survey Team

## 2-5 Project Cost Estimation

### 2-5-1 Initial Cost Estimation

#### (1) Cost Japan Needs to Bear

This chapter is closed due to the confidentiality.

#### (2) Cost Ethiopia Needs to Bear

The cost to be borne by the Government of Ethiopia is listed below.

Approx. USD 99,000

Item		Estimated Cost (USD)
Preparation for the delivery of equipment	Securing equipment yards and a storage for spare parts	27,000
	Securing the asphalt plant yards, leveling, storage for materials and equipment, security measures, etc.	18,000
Cost for operation and maintenance training for the Road Stabilizer	Pilot works and mix design test	9,000
	Preparation of pilot works and asphalt pavement works after training	27,000
Bank Commissions		18,000

In addition to the above cost, the Government of Ethiopia is necessary to secure a budget of approx. USD 39 million in order to implement the construction and maintenance of the target roads in three years after achievement of the Project.

#### (3) Estimation Conditions

1. Time of estimation : April 2019
2. Exchange rate : 1 US dollar = 111.21 yen, 1 EUR= 126.65 yen
3. Procurement : The procurement period is in accordance with the implementation period schedule in Section 2-2-4-9.
4. Miscellaneous : The cost is estimated based on the Grant Aid Scheme of the Government of Japan.



## 2-5-2 Operation and Maintenance Cost

It is essential that AACRA maintain the construction equipment to be procured in the Project sustainably for its efficient operation. Thus, the government needs to allocate the necessary budget based on an efficient operation and maintenance plan and properly maintain it. The equipment maintenance and fuel cost to be borne by the Ethiopian side is described below.

### (1) Equipment Maintenance Cost

The annual maintenance cost (regular maintenance and on-site repair, etc.) of the road maintenance equipment to be procured in the Project is estimated to be 515,317 ETB (approx. 18,000USD) in the target road maintenance period of approx. three years after the delivery of the equipment (See Table 2-5.1). This is mainly the cost of improvement and maintenance with the spare parts for about 3,000 hours of operation) to be procured in the Project, which is equivalent to 1.4 percent of the equipment purchase and actual annual average maintenance cost of the last three years of AACRA. The agency needs to inject properly the maintenance budget.

Table 2-5.1 Estimated Maintenance Cost in Initial Three Years

Name of Equipment	Machine's life span (years)	Mainte. cost Rate (in life span) (%)	Av. mainte. cost/year (ETB)	Number of machines	Maintenance costs for equipment in initial 3 years		
					Cost rate (%)	Cost/unit (ETB)	Annual expenditure (ETB)
1 Wheel Loader	10	55	267,306	3	5	13,365	40,096
2 Backhoe Loader	10	40	140,409	7	5	7,020	49,143
3 Excavator	10	30	60,313	5	5	3,016	15,078
4 Road Stabilizer	12	55	656,831	1	5	32,842	32,842
5 Sheep-foot Compactor	13	35	100,284	5	5	5,014	25,071
6 Vibratory Tandem Roller	13	30	45,134	5	5	2,257	11,284
7 Tyre Roller	15	35	74,835	3	5	3,742	11,225
8 Water Truck	12	40	90,263	3	5	4,513	13,539
9 Dump Truck	12	45	106,921	10	5	5,346	53,460
10 Cab-back Crane (3 ton)	12	40	75,902	2	5	3,795	7,590
11 Cab-back Crane (8 ton)	12	40	132,919	1	5	6,646	6,646
12 Aerial Work Platform Vehicle	13	30	102,638	4	5	5,132	20,528
13 High-pressure Drainage Cleaning Vehicle	12	30	155,238	3	5	7,762	23,286
14 Vacuum Tank Truck	12	30	108,414	3	5	5,421	16,262
15 Bitumen Distributor	11	45	212,051	3	5	10,603	31,808
16 Asphalt Burner (Torch)	7		0	5		0	0
17 Asphalt Cutter	8	35	4,008	5	5	200	1,002
18 Asphalt Crack Sealer	5	45	38,734	5	5	1,937	9,684
19 Portable Air Compressor	11	50	82,713	4	5	4,136	16,543
20 Air Breaker	6	25	1,035	5	5	52	259
21 Portable Mini Asphalt Mixer	10	30	74,007	3	5	3,700	11,101
22 Asphalt Plant	10	40	2,168,078	1	5	108,404	108,404
23 Mobile Workshop	12	40	209,349	1	5	10,467	10,467
Estimated annual expenditure for machinery maintenance in initial three years							515,317
Average annual expenditure for machinery maintenance in AACRA (for the last four years , 2016-2018)							37,544,850
The rate of increase in expenditure for machinery maintenance based on the average annual expenditure for last three years (%)							1.4

Exchange rate: 1 Japanese yen – 0.26 ETB (as of April 2019), 1 ETB – 0.035 USD (as of April 2019)

Note) Since the spare parts for initial 3000 hours operation will be provided along with each machine, a rate of the equipment maintenance cost in initial three year bearing by AACRA is estimated to be about 5 % of the average maintenance cost per year.

Source: Prepared by the Survey Team

AACRA also needs to procure additional spare parts continuously during the useful-life period of the equipment after all the parts to be procured in the Project are used, and it needs to perform proper maintenance including heavy maintenance. The annual maintenance cost after the use of the Project spare parts (for 3,000 hours of operation mentioned above) is estimated to be 5,436,507 ETB

(approx. 190,000USD) (See Table 2-5.2).

Table 2-5.2 Estimated Maintenance Cost Three Years after Delivery

	Name of Equipment	Parts supply through the project (%)	Maintenance cost rate of the project (%)	Maintenance cost rate after completion of the Project (%)	Average amount of maintenance cost/year after completion of the (ETB)
1	Wheel Loader	10	15	4.3	624,871
2	Backhoe Loader	10	15	2.1	526,535
3	Excavator	10	15	0.7	71,801
4	Road Stabilizer	10	15	3.3	477,695
5	Sheep-foot Compactor	10	15	1.0	186,242
6	Vibratory Tandem Roller	10	15	0.5	48,896
7	Tyre Roller	10	15	0.8	80,180
8	Water Truck	10	15	1.7	135,395
9	Dump Truck	10	15	2.2	633,604
10	Cab-back Crane (3 ton)	10	15	1.7	75,902
11	Cab-back Crane (8 ton)	10	15	1.7	66,459
12	Aerial Work Platform Vehicle	10	15	0.5	88,953
13	High-pressure Drainage Cleaning Vehicle	10	15	0.6	103,492
14	Vacuum Tank Truck	10	15	0.6	72,276
15	Bitumen Distributor	10	15	2.5	388,759
16	Asphalt Burner (Torch)	3			0
17	Asphalt Cutter	3	15	3.4	15,574
18	Asphalt Crack Sealer	3	15	13.5	290,507
19	Portable Air Compressor	10	15	3.1	227,460
20	Air Breaker	3	15	2.3	2,897
21	Portable Mini Asphalt Mixer	10	15	0.7	52,862
22	Asphalt Plant	10	15	2.1	1,161,470
23	Mobile Workshop	10	15	1.7	104,674
Estimated annual expenditure for equipment maintenance after the achievement of the Project					5,436,507
The rate of maintenance cost based on the average annual expenditure for last three years (%)					14.5

Exchange rate: 1 Japanese yen – 0.26 ETB (as of April 2019), 1 ETB – 0.035 USD (as of April 2019)

Source: Prepared by the Survey Team

As shown in the above table, the annual maintenance cost until the end of the useful-life period is approx. 14.5 percent of the equipment maintenance budget of the last three years, and thus should be affordable. AACRA needs to secure the budget for proper operation and maintenance of equipment to be procured and for steady promotion of the target road improvement.

In the Soft Component of the Project, the introduction of database for the management of construction equipment is planned. This will improve AACRA's capacity to administer operation and maintenance of construction equipment properly and efficiently. The management and control of machines' operation and maintenance/repair, as well as spare parts can be easily, efficiently and systematically performed by using the database to manage the data of each machine (inventory, operation, maintenance/repair, and parts control data). The introduction of database will enable AACRA to predict when heavy repairs (engine overhaul etc.) are required for each machine, and help to plan for procurement of spare parts, and to secure budget for equipment maintenance.

## (2) Fuel Cost

The fuel cost required for the construction of roads directly maintained by AACRA is provided in Table 2-5.3. AACRA needs to secure the fuel cost of approx. 24,579,000 ETB (approx. 860,000USD) to promote the target road improvement and maintenance more steadily using the equipment to be procured.

Table 2-5.3 Estimated Fuel Cost for Target Road Maintenance

Name of Equipment	Engine Output (kW) (a)	Fuel Consumption Rate		Working Hrs. (hrs./year) (d)	Number of Machines (e)	Fuel Consumption (ℓ/year) (f) = c×d×e	Fuel Price (ETB/ℓ) (g)	Fuel Costs/year (ETB×1000) (h) = f×g
		(ℓ/kW·h) (b)	(ℓ/h) (c) = a×b					
1 Wheel Loader	120	0.153	18.4	1000	3	55,080	18.8	1,036
2 Backhoe Loader	70	0.153	10.7	1000	7	74,970	18.8	1,409
3 Excavator	28	0.153	4.3	1000	5	21,420	18.8	403
4 Road Stabilizer	300	0.111	33.3	800	1	26,640	18.8	501
5 Sheep-foot Compactor	80	0.160	12.8	1000	5	64,000	18.8	1,203
6 Vibratory Tandem Roller	19	0.160	3.0	1000	5	15,200	18.8	286
7 Tyre Roller	65	0.085	5.5	1000	3	16,575	18.8	312
8 Water Truck	150	0.044	6.6	1000	3	19,800	18.8	372
9 Dump Truck	190	0.043	8.2	1000	10	81,700	18.8	1,536
10 Cab-back Crane (3 ton)	190	0.043	8.2	500	2	8,170	18.8	154
11 Cab-back Crane (8 ton)	190	0.043	8.2	500	1	4,085	18.8	77
12 Aerial Work Platform Vehicle	115	0.044	5.1	400	4	8,096	18.8	152
13 High-pressure Drainage Cleaning Vehicle	150	0.053	8.0	400	3	9,540	18.8	179
14 Vacuum Tank Truck	150	0.053	8.0	400	3	9,540	18.8	179
15 Bitumen Distributor	115	0.090	10.4	300	3	9,315	18.8	175
16 Asphalt Burner (Torch)			0.0		5	0	18.8	0
17 Asphalt Cutter	8.0	0.227	1.8	100	5	908	19.5	18
18 Asphalt Crack Sealer	2.5	0.227	0.6	100	5	284	19.5	6
19 Portable Air Compressor	60.0	0.595	35.7	500	4	71,400	18.8	1,342
20 Air Breaker			0.0	500	5	0	18.8	0
21 Portable Mini Asphalt Mixer	14	0.180	2.5	500	3	3,780	18.8	71
22 Asphalt Plant (generator)	300	0.145	43.5	1200	1	52,200	18.8	981
23 Asphalt Plant (burner)			750.0	1000	1	750,000	18.8	14,100
24 Mobile Workshop (carrier)	140	0.043	6.0	500	1	3,010	18.8	57
25 Mobile Workshop (generator-cum-welder)	15	0.145	2.2	250	1	544	18.8	10
26 Container Workshop (generator)	15	0.145	2.2	500	1	1,088	18.8	20
Estimated annual expenditure for fuel								24,579

Exchange rate: 1 Japanese yen – 0.26 ETB (as of April 2019), 1 ETB – 0.035 USD (as of April 2019)

Fuel price per liter diesel: 18.8 ETB; petrol: 19.5 ETB (as of April 2019)

Source: Prepared by the Survey Team

## **CHAPTER 3**

# **PROJECT EVALUATION**

## **Chapter 3 Project Evaluation**

### **3-1 Preconditions**

The Ethiopian side is required to undertake the following tasks for the Project implementation:

- Ensure import tax exemption, customs clearance and smooth domestic transportation of the provided equipment.
- Bear customs duties, domestic taxes and other fiscal levies which may be imposed in Ethiopia with respect to the purchase of the products.
- Fulfill all the legal requirements necessary for the Japanese citizens to be engaged in the Project, to enter Ethiopia and stay there.
- Ensure proper operation and maintenance of provided equipment.
- Bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.
- Bear banking service fees for the bank account to be opened in Japan in relation to the Project

### **3-2 Necessary Inputs by Recipient Country**

The Ethiopian side shall be responsible for the following items to achieve the overall goal of the Project:

- Securing the place of delivery of equipment (preparation of workshop facility).
- Securing spare part storage.
- Launching road improvement works of target roads swiftly after equipment procurement.
- Transporting the equipment locally to the construction sites of the target roads.
- Assigning engineers and operators necessary for the above road improvement work.
- Acquiring land necessary for the improvement of the target roads.
- Operating and maintaining the equipment to be procured in the Project properly, and assigning necessary manpower for it.
- Operating devices (desktop computer) procured for the Soft Component of the Project and equipment control system properly and sustainably.
- Planning the road improvement considering commuting children and other passers-by.
- Providing sufficient explanation to local residents about the road improvement schedule and matters to which attention should be paid when implementing the road improvement work.

### **3-3 Important Assumption**

Addis Ababa is encircled by Oromia Regional State, with no clearly defined boundaries. The 10th Addis Ababa master plan triggered protests in Oromia, and led to its cancellation in 2016. Therefore, dispute over the border has become a series issue that could hinder the development of the city.

Protests over the boundary have been observed recently when Addis Ababa tried to distribute condominium houses built on land claimed by Oromia. Following these protests, the Ethiopian Prime Minister established a committee to resolve the administrative boundary issue in May 2019. Although efforts are underway to address this issue, the equipment procurement and road development of the Project needs to pay close attention to this dispute and its implications.

## **3-4 Project Evaluation**

### **3-4-1 Relevance**

The Government of Japan has established the following key assistance areas for Ethiopia to promote stability and development, and contribute to stable development of international economy including East Africa and Japan.

- ① Agricultural and rural development
- ② Industry promotion
- ③ Infrastructure development
- ④ Education and insurance

The Project belongs to the third (infrastructure development) of the four focus areas listed above, and the Project is deemed to align with Japan's policy for assistance to Ethiopia. In addition, it will contribute to the development of high-quality human resources in the field of infrastructure development through the promotion of road maintenance and technical guidance for equipment operation and maintenance through the soft component of the Project.

Road traffic in Addis Ababa City is concentrated on the main roads or the streets whose pavement condition is relatively good. This has led to the deterioration of pavement condition, and chronic traffic congestion. Such deterioration of the city's traffic condition could hinder the growth of not only the economy of Addis Ababa City, but also that of Ethiopia. Besides, such deterioration of the traffic condition may reduce the accessibility of the citizens to social services such as medical care and education. In recent years, this issue has been considered as a serious problem that could undermine the social stability of Addis Ababa City, which is rapidly urbanizing.

Therefore, in order to contribute to the stable and sustainable growth of the economy of Ethiopia and improve the living standard of citizens of Addis Ababa City, the road maintenance capacity of AACRA has to be urgently improved.

As such, improvement and maintenance of the target roads is urgent and prioritized by the Government of Ethiopia, and hence it is concluded that the Project is relevant.

### **3-4-2 Effectiveness**

#### **(1) Quantitative Effects**

Table 3-4.1 shows expected quantitative effects of the road improvement works in the Project.

It is expected that the annual road maintenance length will increase from 113km to 140km. Moreover, the equipment operation rate is expected to increase from 79% to 88%.

Table 3-4.1 Quantitative Effects of Road Improvement

Indicator		Target	Current (2019) Level	Target Year (2024) Level
Indicator -1	Annual Road Maintenance Length	Addis Ababa City Roads Total length of the targeted road: 2,151 km	113km per year	140km per year
Indicator -2	Equipment Operation Rate	Road Maintenance Equipment	79%	88%

Source: Prepared by the Survey Team

Out of the two indicators shown in the table above, Indicator-1, “Annual Road Maintenance Length”, is set based on the maintenance records and visual observations recorded by AACRA. Indicator-2, “Equipment Operation Rate”, is set based on the equipment operation records of AACRA.

## (2) Qualitative Effects

The expected qualitative effect of the Project is summarized below.

### 1) Improvement of Road Safety

Improving the road pavement condition enables stable traffic flow throughout the year, and helps in reducing traffic congestion. The improved road may increase the safety of the pedestrians of the city by reducing the vehicles maneuvering to avoid damaged road sections.

In addition, the improvement of the drainage facilities may reduce the number of closed roads due to flooding, thereby reducing the traffic congestion and improving traffic safety. This is in line with the policies of targets 3.6 “By 2020, halve the number of global deaths and injuries from road traffic accidents” in the Sustainable Development Goals (hereinafter referred to as SDGs).

### 2) Increase in Passenger and Freight Transportation Efficiency

The construction and improvement of Addis Ababa City roads may lead to the reduction of travel time and costs. Therefore, the flow of passenger and freight traffic into and out of the city as well as within the city will be more efficient. As a result, activation of economic activity can be expected.

### 3) Improvement of Accessibility to Social Services (schools, medical facilities, etc.)

Improvement of accessibility to social services such as schools and medical facilities can be expected by shortening the travel time through improving the road pavement condition. In other words, the Project has the potential to save lives as patients, especially in emergency cases, could access medical care in a shorter time. This is in line with the policies of targets 3.8 “Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all” in SDGs.

### 4) Improvement of Sanitary Environment

The equipment to be procured will improve the sanitary condition of the city by improving the drainage facilities. It is, particularly, expected to improve the living condition of the residents living along the road.

Based on the analysis of this chapter, it is concluded that this Project is relevant and is expected to be effective.

## **APPENDICES**



## **APPENDIX 1**

### **MEMBER LIST OF THE STUDY TEAM**

## 1. Member List of the Study Team

### 【First Field Survey】

Name	Work Assignment	Position
Kenshiro TANAKA	Mission Leader	Japan International Cooperation Agency (JICA)
Yuichiro TAKADA	Planning Management	Japan International Cooperation Agency (JICA)
Isao TAKAHASHI	Chief Consultant /Road Planner 1	Yachiyo Engineering Co., Ltd.
Masatsugu KOMIYA	Deputy Chief Consultant / Road Planner 2	Yachiyo Engineering Co., Ltd.
Etsuo HASHIGUCHI	Equipment Arrangement Planner	Yachiyo Engineering Co., Ltd.
Makoto SUGIYAMA	Maintenance Planner	Yachiyo Engineering Co., Ltd.
Esmael Mohamed OMER	Procurement / Cost Estimator 1	Yachiyo Engineering Co., Ltd.
Shunsuke HORIUCHI	Procurement / Cost Estimator 3	Yachiyo Engineering Co., Ltd.

**【Second Field Survey】**

Name	Work Assignment	Position
Takeshi MATSUYAMA	Mission Leader	Japan International Cooperation Agency (JICA)
Masahiro SUZUKI	Planning Management	Japan International Cooperation Agency (JICA)
Isao TAKAHASHI	Chief Consultant /Road Planner 1	Yachiyo Engineering Co., Ltd.
Etsuo HASHIGUCHI	Equipment Arrangement Planner	Yachiyo Engineering Co., Ltd.
Koji MASUDA	Safety Management	Yachiyo Engineering Co., Ltd.
Esmael Mohamed OMER	Procurement / Cost Estimator 1	Yachiyo Engineering Co., Ltd.
Shunsuke HORIUCHI	Procurement / Cost Estimator 3	Yachiyo Engineering Co., Ltd.

## **APPENDIX 2**

### **STUDY SCHEDULE**

## First Field Survey Schedule

Day	Date		JICA	Consultant					Accommodation	
				Chief Consultant/Road Maintenance Planner1	Deputy Chief Consultant/Road Maintenance Planner2	Equipment Arrangement Planner	Maintenance Planner	Procurement / Cost Estimator1		Procurement / Cost Estimator3
				Mission Leader/ Planning Management	Isao TAKAHASHI	Masatsugu KOMIYA	Etsuo HASHIGUCHI	Makoto SUGIYAMA		Esmael Mohamed OMER
1	13-Mar-19	Wed	-	Narita to Dubai by flight EK319 (22:00->05:00(+1))					Airplane	
2	14-Mar-19	Thu	-	Dubai to Addis Ababa by flight EK723 (9:25->12:40) • 16:00 Meeting with JICA Ethiopia Office					Addis Ababa City	
3	15-Mar-19	Fri	-	• Field Survey • 13:00 Interview to local agent for construction equipment					Addis Ababa City	
4	16-Mar-19	Sat	-	• 10:00 Meeting with AACRA (AACRA Addis Ababa City Roads Authority) on Inception Report (Mr. Zarihun (Deputy Director General))					Addis Ababa City	
5	17-Mar-19	Sun	Tokyo to Addis Ababa	• Field Survey					Addis Ababa City	
6	18-Mar-19	Mon	-	• 8:30 Courtesy call on JICA Ethiopia Office (Director, Deputy General Manager) • 14:00 Courtesy call on AACRA, Meeting with AACRA (AACRA Addis Ababa City Roads Authority) discussion on Inception Report, M/D					Addis Ababa City	
7	19-Mar-19	Tue	-	• 9:00 Field Survey (AACRA's machinery warehouse, etc.) 11:00 • Interview to AACRA					Addis Ababa City	
8	20-Mar-19	Wed	• Field Survey (AACRA's machinery warehouse, etc.) • Meeting with AACRA (AACRA Addis Ababa City Roads Authority) discussion on M/D	Addis Ababa to Dubai by flight EK724 (16:00->21:10)	• Field Survey			Addis Ababa City		
9	21-Mar-19	Thu	• 9:00 Visit to Embassy of Japan in Ethiopia, report of M/D (Director)	Dubai to Narita by flight EK318 (2:40->17:35)	• Field Survey			Addis Ababa City		
10	22-Mar-19	Fri	• 10:30 Visit to JICA Ethiopia Office, report of survey (Mr. Edamura) • Addis Ababa to Tokyo (JICA)	-	• Field Survey			Addis Ababa City		
11	23-Mar-19	Sat	• Arrive at Tokyo	• Team Meeting	-	Same as Chief consultant			Addis Ababa City	
12	24-Mar-19	Sun	-	• Team Meeting	-	Same as Chief consultant			Addis Ababa City	
13	25-Mar-19	Mon	-	• Meeting with Authorities concerned	-	• Meeting with Authorities concerned (AACRA, ERA, Work Shop etc.)	• Survey for Procurement • Interview to Contractor	Addis Ababa City		
14	26-Mar-19	Tue	-	• Meeting with Authorities concerned	-	• Meeting with Authorities concerned (AACRA, ERA, Work Shop etc.)	• Survey for Procurement • Interview to Contractor	Addis Ababa City		
15	27-Mar-19	Wed	-	• Meeting with Authorities concerned	-	• Meeting with Authorities concerned (AACRA, ERA, Work Shop etc.)	• Survey for Procurement • Interview to Contractor	Addis Ababa City		
16	28-Mar-19	Thu	-	• Preparation of Field Report	-	• Meeting with Authorities concerned (AACRA, ERA, Work Shop etc.)	• Survey for Procurement • Interview to Contractor	Addis Ababa City		
17	29-Mar-19	Fri	-	• Preparation of Field Report	-	Same as Chief consultant			Addis Ababa City	
18	30-Mar-19	Sat	-	• Preparation of Field Survey Report (Draft)	-	Same as Chief consultant			Addis Ababa City	
19	31-Mar-19	Sun	-	• Preparation of Field Survey Report (Draft)	-	Same as Chief consultant	Addis Ababa to Dubai by flight EK724 (16:00->21:10)	Same as Chief consultant	Addis Ababa City	
20	1-Apr-19	Mon	-	• Meeting with AACRA discussion on Field Report	-	Same as Chief consultant	Dubai to Narita by flight EK318 (2:40->17:35)	Same as Chief consultant	Addis Ababa City	
21	2-Apr-19	Tue	-	• Meeting with AACRA	-	Same as Chief consultant	-	Same as Chief consultant	Addis Ababa City	
22	3-Apr-19	Wed	-	• Preparation of Field Survey Report (Draft)	-	Same as Chief consultant	-	Addis Ababa to Dubai by flight EK724 (16:00->21:10)	Same as Chief consultant	Addis Ababa City
23	4-Apr-19	Thu	-	• Preparation of Field Survey Report (Draft)	-	Same as Chief consultant	-	Dubai to Narita by flight EK318 (2:40->17:35)	Addis Ababa to Dubai by flight EK724 (16:00->21:10)	Addis Ababa City
24	5-Apr-19	Fri	-	• Visit to Embassy of Japan in Ethiopia, report of survey • Visit to JICA Ethiopia Office, submit Field Survey Report	-	Same as Chief consultant	-	Dubai to Narita by flight EK318 (2:40->17:35)	Addis Ababa City	
25	6-Apr-19	Sat	-	• Team Meeting	-	Same as Chief consultant	-	-	Addis Ababa City	
26	7-Apr-19	Sun	-	Addis Ababa to Dubai by flight EK724 (16:00->21:10)	-	Addis Ababa to Dubai by flight EK724 (16:00->21:10)	-	-	Airplane	
27	8-Apr-19	Mon	-	Dubai to Narita by flight EK318 (2:40->17:35)	-	Dubai to Narita by flight EK318 (2:40->17:35)	-	-	-	

## Second Field Survey Schedule

Day	Date		JICA		Consultant			Accommodation	
			Planning Management	Chief Consultant/Road Maintenance Planner <sup>1</sup>	Equipment Arrangement Planner	Procurement / Cost Estimator <sup>3</sup>	Safety Management		Procurement / Cost Estimator <sup>1</sup>
			Masahiro SUZUKI	Isao TAKAHASHI	Etsuo HASHIGUCHI	Shunsuke HORIUCHI	Koji MASUDA		Esmael Mohamed OMER
1	23-Mar-19	Fri	-	Narita to Addis Ababa by flight ET673 (21:25→07:45(+1))			-	Airplane	
2	24-Mar-19	Sat	-	• Arrive at Addis Ababa			Narita to Bangkok by flight ET1411 (18:25→23:10)	Addis Ababa City	
3	25-Mar-19	Sun	• Arrive at Addis Ababa	• Team Meeting • Safety Management Seminar (Preparation)			Bangkok to Addis Ababa by flight ET629 (1:20→6:05)	Addis Ababa City	
4	26-Mar-19	Mon	• 9:00 Meeting with JICA Ethiopia Office • 11:30 Meeting with AACRA (Addis Ababa City Roads Authority) discussion on DFR, M/D • Safety Management Seminar (Preparation)					Addis Ababa City	
5	27-Mar-19	Tue	• 8:30 Safety Management Seminar • 16:00 Meeting with AACRA discussion on DFR, M/D					Addis Ababa City	
6	28-Mar-19	Wed	• 9:30 Safety Management Seminar • 11:30 Meeting with AACRA discussion on M/D					Addis Ababa City	
7	29-Mar-19	Thu	• 9:00 Meeting with AACRA discussion on M/D • 10:30 Signing of M/D			• Compile Safety Management Seminar	Addis Ababa to Narita by flight ET672 (23:25→20:25(+1))	Addis Ababa City	
8	30-Mar-19	Fri	• 9:00 Report to JICA Ethiopia Office • 10:30 Report to Embassy of Japan in Ethiopia • Addis Ababa to Tokyo	• 9:00 Report to JICA Ethiopia Office • 10:30 Report to Embassy of Japan in Ethiopia			• Arrive at Tokyo	Addis Ababa City	
9	31-Mar-19	Sat	• Arrive at Tokyo	Addis Ababa to Narita by flight ET672 (23:25→20:25(+1))			-	Airplane	
10	1-Apr-19	Sun	-	• Arrive at Tokyo			-	-	

## **APPENDIX 3**

### **LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY**

### 3. List of Parties Concerned in the Recipient Country

<u>Name of Organization</u>	<u>Position</u>
<b>Addis Ababa City Road Authority</b>	
Mr. MOGES Tibebu	Director General
Mr. DEMELASH G/Mariam	Deputy Director General, Road Asset Management
Mr. SHIFERAW Bekele	Deputy Director General, Institutional Change and Support Stream
Mr. ZERIHUM Yifru	Deputy Director General, Engineering Operation
Mr. FITSUM Tamiru	Director of Technical Adviser to General
Mr. ZEBENE Waletu	Director of Equipment Supply, Administration and Maintenance Directorate
Mr. MEKONNEN Tibebu	Director of Own Force Maintenance Directorate
Mr. ADDISU Assefa	Director of Planning Budget and Management Directorate
Mr. ASENAKE Aderaro	Director of Road Asset Coordination and Central Data Base Mngement Directorate
Mr. ATO Sintayehu Asrat	Director of Finance Management Directorate
<b>Ministry of Revenues</b>	
Mr. WEGAYOHU Adamn	Director of Customs Commission
Mr. ANNENNEL Aschsee	Customs Commission
<b>Embassy of Japan in Ethiopia</b>	
Mr. Nobuhisa EDAMURA	First Secretary, Economic Division
Mr. Kento SAKAI	Second Secretary, Economic Cooperation Division
<b>Japan International Cooperation Agency Ethiopia Office</b>	
Mr. Makoto SHINKAWA	Chief Representative
Mr. Takeshi MATSUYAMA	Senior Representative
Mr. Gaku SAITO	Representative
Ms. Haruka NAKAGAWA	Representative
Ms. Yoko NAKAJIMA	Project Formulation Advisor
Ms. ABEBAWORK Abebe	Program Officer



## **APPENDIX 4**

### **MINUTES OF DISCUSSIONS**


**Minutes of Discussions**  
**on the Preparatory Survey for the Project for**  
**Upgrading Road Maintenance Equipment in Addis Ababa City**

In response to the request from the Government of the Federal Democratic Republic of Ethiopia (hereinafter referred to as “Ethiopia”), Japan International Cooperation Agency (hereinafter referred to as “JICA”) dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as “the Team”) of the Project for **Upgrading Road Maintenance Equipment in Addis Ababa City** (hereinafter referred to as “the Project”) to Ethiopia. The Team held a series of discussions with the officials of the Government of Ethiopia and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Addis Ababa, 21 March, 2019

  
Mr. Kenshiro Tanaka  
Team Leader  
Preparatory Survey Team  
Japan International Cooperation Agency



  
Eng. Moges Tibebu  
Director General  
Mr. Moges Tibebu  
Director General  
Addis Ababa City Roads Authority  
The Federal Democratic Republic of Ethiopia



## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to enhance the existing capacity of Addis Ababa City Roads Authority (hereinafter referred to as “AACRA”) by supplying equipment necessary for maintenance of the city roads, thereby contributing to effective utilization of road assets.

### 2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for Upgrading Road Maintenance Equipment in Addis Ababa City”.

### 3. Project Site

Both sides confirmed that the sites of the Project are in Addis Ababa, which is shown in Annex 1.

### 4. Responsible Authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

4-1. AACRA will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization charts are shown in Annex 2.

4-2. Addis Ababa City Administration shall be responsible for supervising the Executing Agency on behalf of the Government of Ethiopia.

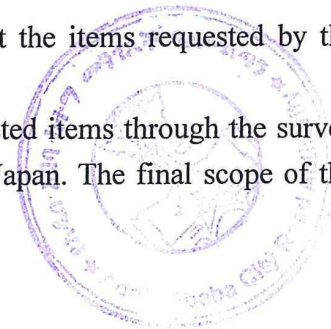
### 5. Items requested by the Government of Ethiopia

As a result of discussions, both sides confirmed that the items requested by the Government of Ethiopia are in Annex 3.

5-1. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

### 6. Procedures and Basic Principles of Japanese Grant

6-1. The Ethiopian side agreed that the procedures and basic principles of Japanese



Grant as described in Annex 4 shall be applied to the Project. As for the monitoring of the implementation of the Project, JICA requires the Ethiopian side to submit the Project Monitoring Report that the form is attached as Annex 5.

- 6-2. The Ethiopian side agreed to take the necessary measures, as described in Annex 6, for smooth implementation of the Project. The contents of the Annex 6 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.

The contents of Annex 6 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

#### 7. Schedule of the Survey

7-1. The Team will proceed with further survey in Ethiopia until 7 April, 2019.

7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Ethiopia in order to explain its contents around August, 2019.

7-3. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Ethiopian side, JICA will finalize the Preparatory Survey Report and send it to the Ethiopian side around December, 2019.

7-4. The above schedule is tentative and subject to change.

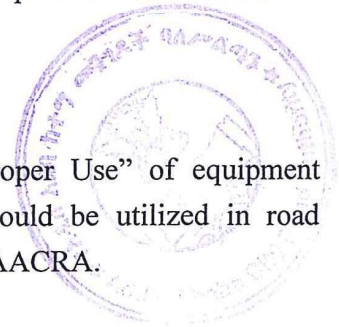
#### 8. Environmental and Social Considerations

8-1. The Ethiopian side confirmed to give due environmental and social considerations during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

8-2. The Project is categorized as “C” from the following considerations: Not located in a sensitive area, nor has it sensitive characteristics, nor falls it into sensitive sectors under the Guidelines, and its potential adverse impacts on the environment are not likely to be significant.

#### 9. Proper Use of Equipment

The Ethiopian side understood the importance of “Proper Use” of equipment procured under the Japan Grant Scheme and they should be utilized in road construction for the road sections which are specified by AACRA.



#### 10. Other Relevant Issues

10-1. The Team explained the methodology of the Preparatory Survey based on the

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Inspection Report. The Ethiopian side understood the contents and accepted the Report.

10-2. The Ethiopian side shall at its own expenses, provide the Team with the following items in cooperation with organizations concerned.

- (1) Security-related information as well as measures to ensure the safety of the Team members;
- (2) Information as well as support in obtaining medical service;
- (3) Data and information related to the Preparatory Survey;
- (4) Counterpart personnel;
- (5) Suitable office space with necessary equipment and services;
- (6) Credentials or identification cards;
- (7) Entry permits necessary for the Team members to conduct field surveys; and
- (8) Support in obtaining other privileges and benefits if necessary.

10-3. The Ethiopian side shall secure temporary construction yard, stock yard, venue and personnel necessary for the initial training of equipment procured by the Project. Also, the Ethiopian side shall acquire all necessary approval and license from relevant stakeholders before the initial training.

10-4. The Ethiopian side shall secure enough budget and personnel necessary for the operation and maintenance of equipment procured by the Project, including the periodical maintenance work after the completion of the Project.

10-5. AACRA shall answer to the Questionnaire submitted by the Team in English with relevant documents by 22 March, 2019.

Annex 1 Project Site

Annex 2 Organization Chart

Annex 3 List of Requested Equipment

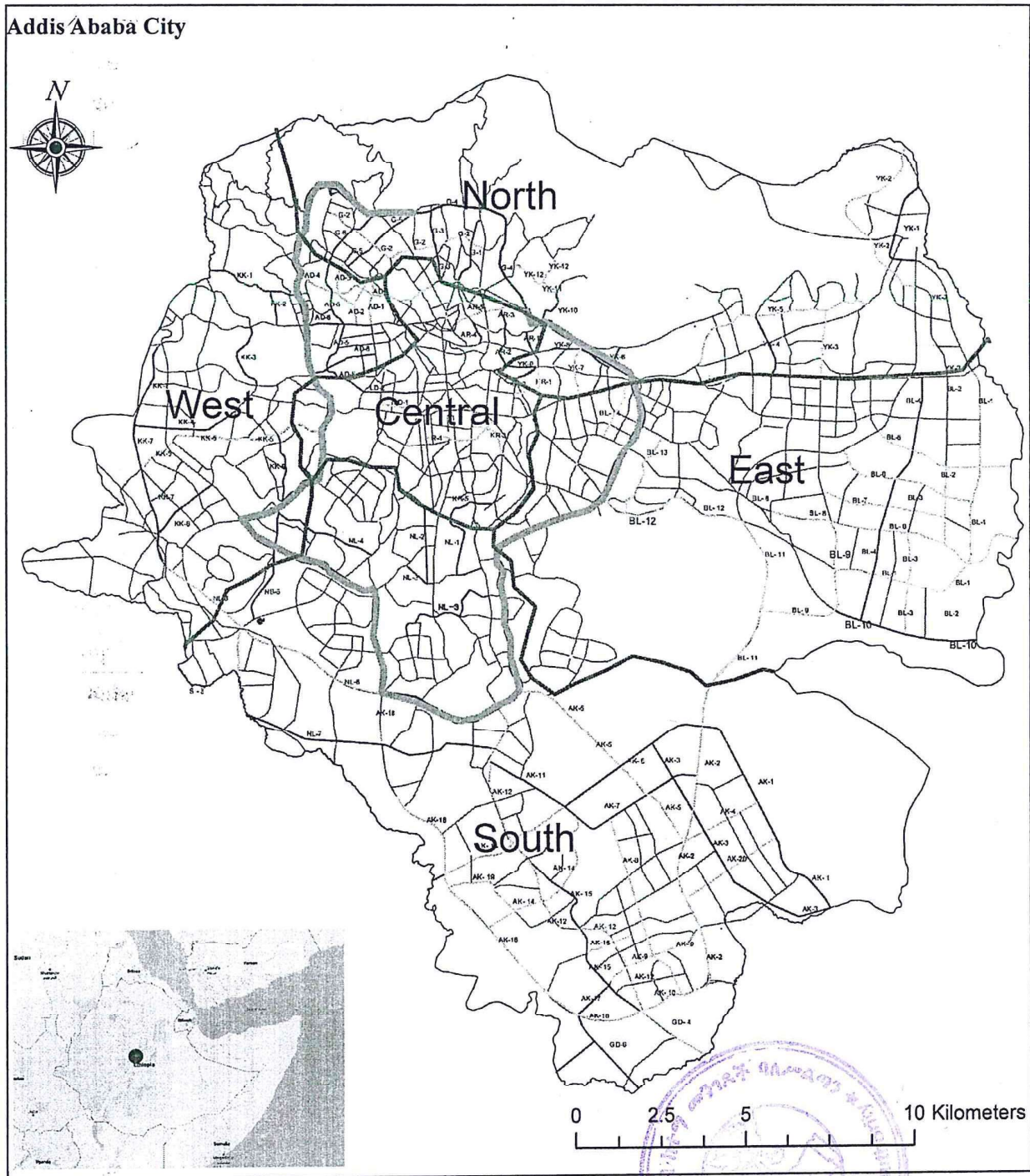
Annex 4 Japanese Grant

Annex 5 Project Monitoring Report (template)





Annex 6 Major Undertakings to be taken by the Government of Ethiopia



Project Site



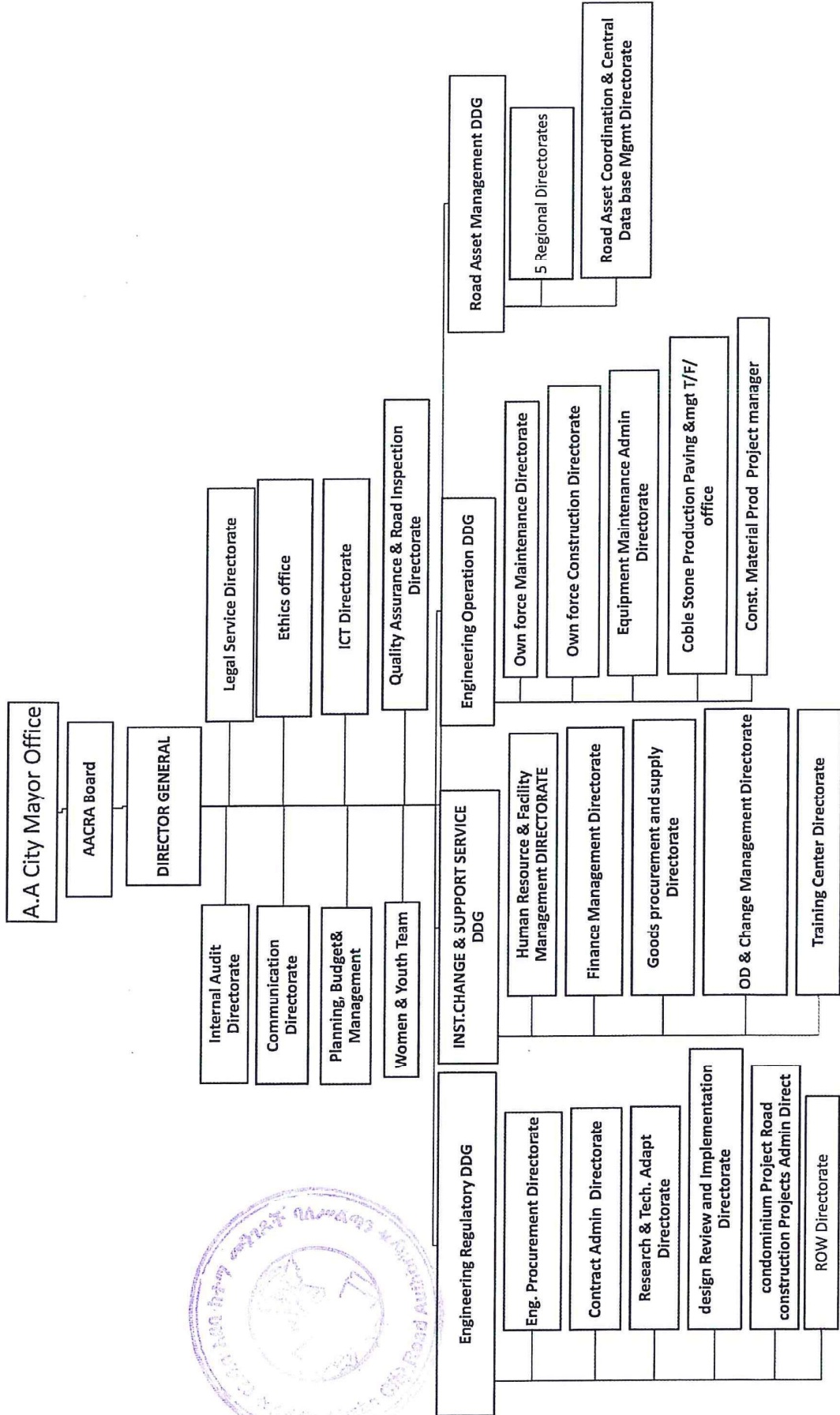
Legend :

-  : First 5 year Target Roads (2016-2020)
-  : Second 5 year Target Roads (2021-2025)
-  : Ring Road
-  : AACRA Division Borders

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Organization Chart



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## Tentative Requested Equipment Component

Note: The necessity and quantity of the equipment will be determined in consideration of type of works and volume of in the Project, and financial condition of AACRA.

The equipment which will be determined to be unnecessary for the Project will be omitted from the list.

Priority : A= 1st, B=2nd

No.	Name of Equipment	Specification	Quantity	Priority
1	Asphalt Batch Plant	Capacity: 80 ton/hr. <u>Composition of the Plant</u> Aggregate Hopper & Feeding System Screen Drum, Dryer & Hot-bin System Weighing Unit & Mixing System Bag Filter Control unit Filler Supply System Bitumen Decanting System Bitumen Supply System Generator	1	A
2	Crushing & Screening Plant	Capacity: 100 ton/hr. <u>Composition of the Plant</u> Grizzly Hopper and Feeder Primary Crusher Screen Unit Secondary Crusher Belt Conveyors Control Unit Generator	1	B
3	Portable Mini. Hot Asphalt Drum Mixer	Capacity: 10 ton/hr.	3	A
4	Vibratory Tandem Roller	Operation Weight: Approx. 4,000 kg Smooth Drum (front & rear) Vibration Power: Approx. 26~34 kN Compaction Width: Approx. 1,300 mm	5	A
5	Vibratory Tandem Roller	Operation Weight: Approx. 7,000 kg Smooth Drum (front & rear) Vibration Power: Approx. 69 kN Compaction Width: Approx. 2,000 mm	2	A
6	Tyre Roller	Operation Weight: 8 ~ 15 ton Travel speed: 0 ~ 20 km/h Compaction Width: Approx. 2,000 mm	3	A
7	Plate Compactor	Operation Weight: 60 ~ 70 kg Centrifugal force: 6~10 kN Vibrating plate size : Approx. 550 × 350 mm	10	B
8	Rammer	Petrol Engine Driven Weight: 60~75 kg Impact Force: 13 ~ 15 kN	10	B
9	Asphalt Kettle	Tank capacity : Approx. lit Direct heating type with diesel fuel burner Electric hoist for asphalt drum Electric asphalt transfer pump with heater Generator	5	A
10	Road Stabilizer	Operation Weight: Approx. 22,000 kg Cutting Width: 2 m	1	A
11	Combined Vibratory (Flat Roll) Roller	Operation Weight: Approx. 13 ton Smooth Drum (Front) Vibration Power: Approx. 245 kN Compaction Width: Approx. 2,100 mm	5	B



12	Water Tanker (with Spray bar)	Payload: 10 ton, (10,000 lit.) GVW: Approx. 23 ton	3	A
13	Dump Truck with U-shape Vessel	Payload: 14 ton Vessel Capacity: Approx. 14m <sup>3</sup> GVW: Max. 26 ton	10	A
14	Truck Mounted Sewer Cleaning Water Jet System	Water Tank Capacity: 10,000 lit. Pump Capacity: Approx. 100 lit./min, 16 MPa	3	A
15	Aerial Work Platform Vehicle	Max. Bucket Height: not less than 12 m Max. Bucket Capacity: not less than 200 kg	4	A
16	Mini. Excavator with Steel Crawler	Operation Weight: Approx. 5,000 kg Bucket Capacity: Approx. 0.15 m <sup>3</sup>	5	A
17	Asphalt Burner (Torch)	Propane/LPG Gas burner	5	A
18	Hand Operated Jack Hammer	Weight: less than 20 kg bpm: Approx. 1,000	5	A
19	Asphalt Cutter	Petrol Engine Driven Wet type Max. Cutting Depth: Approx. 170 mm	5	A
20	Concrete Cutter	Petrol Engine Driven Wet type Max. Cutting Depth: Approx. 170 mm	2	B
21	Wheel Excavator	Bucket capacity: Approx. 0.6 m <sup>3</sup> Max. Digging Depth: Approx. 5 m Max. Cutting Height: Approx. 9 m Operation Weight: Approx. 16 ton	5	A
22	Wheel Loader	Bucket Capacity: Approx. 3.0 m <sup>3</sup> Operation Weight: 17~20 ton Max Dumping Clearance: Approx. 3 m	5	A
23	Asphalt Finisher	Wheel type Paving width: 2.0 ~ 7.0 m, Paving Thickness: 10 ~ 150 mm Travel Speed: 1.5 ~ 20 m/min. Hopper capacity: Approx. 10,000 kg	2	B
24	Boom Truck (Cab-back Crane)	Cargo Truck with 3 ton Telescopic Boom Crane Payload: 10 ton	5	A
25	Agitator Truck	Drum capacity: Approx. 8.0 m <sup>3</sup> Agitating: capacity: Approx. 5.0 m <sup>3</sup>	5	B
26	Slip-form Curb Machine (Slip form Paver)	Paving Capacity Max. Width: Approx. 6,000 mm Max. Thickness: Approx. 400 mm To be capable of paving (construct) curbs and barriers	1	B
27	Portable Screw Air Compressor	Air Flow rate: Approx. 7.0 m <sup>3</sup> /min. Air Pressure: Approx. 7.0 MPa	4	A
28	Asphalt Crack Sealer	Kettle Capacity: Approx. 60 lit. Petrol engine driven, with propane/LPG gas burner	5	A
29	Micro Tunnel Boaring Machine	To be confirmed	1	A
30	Sheep Foot Compactor	Operation Weight: Approx. 13 ton Padfoot drum with removable smooth drum Vibration Power: Approx. 245 kN Compaction Width: Approx. 2,100 mm	1	A
31	Road Maintenance System with Cold Asphalt	To be confirmed	1	A



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32	Drone for Bridge Inspection	To be confirmed	1	A
33	Container Workshop (Workshop Equipment)	Container workshop, equipped with necessary tools and equipment for maintaining construction equipment.	2	A
34	Tyre Changer (Workshop Equipment)	Hydraulically Operated Tyre Changer for Construction Equipment Rim Size: 14" ~ 56"	2	A
35	Portable Gantry Crane (Workshop Equipment)	with Manually Operated Chain Block and Geared Trolley Lifting Capacity: 5,000 kg Max. Lifting Height: Approx. 4,000 mm	2	A
36	Wheel Dolly (Workshop Equipment)	Lifting Capacity: 500 kg Tyre Size: 750 ~ 1,430 mm	2	A
37	High Pressure Washer (Workshop Equipment)	Petrol Engine Driven Pressure: 14 Map Discharge capacity: 7 lit./min.	5	A



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## JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

### 1. Procedures of Project Grants

Project Grants are conducted through following procedures (See “PROCEDURES OF JAPANESE GRANT” for details):

#### (1) Preparation

- The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA

#### (2) Appraisal

- Appraisal by the government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet

#### (3) Implementation

Exchange of Notes

- The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as “the G/A”)

- Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as “the B/A”)

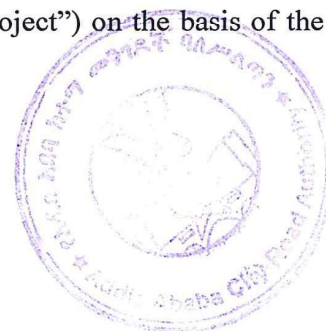
- Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

- Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A

#### (4) Ex-post Monitoring and Evaluation

- Monitoring and evaluation at post-implementation stage



### 2. Preparatory Survey

#### (1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project

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made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

## (2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

## (3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

## 3. Basic Principles of Project Grants

### (1) Implementation Stage

#### 1) The E/N and the G/A



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After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as “the E/N”) will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the “General Terms and Conditions for Japanese Grant (January 2016).”

2) Banking Arrangements (B/A) (See “Financial Flow of Japanese Grant (A/P Type)” for details)

- a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.
- b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA’s procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project’s implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

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The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

#### 8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

#### 9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the “Meeting”) will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client’s obligation, during of construction.

#### (2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

#### (3) Others

##### 1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).



## 2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

## 3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

## 4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

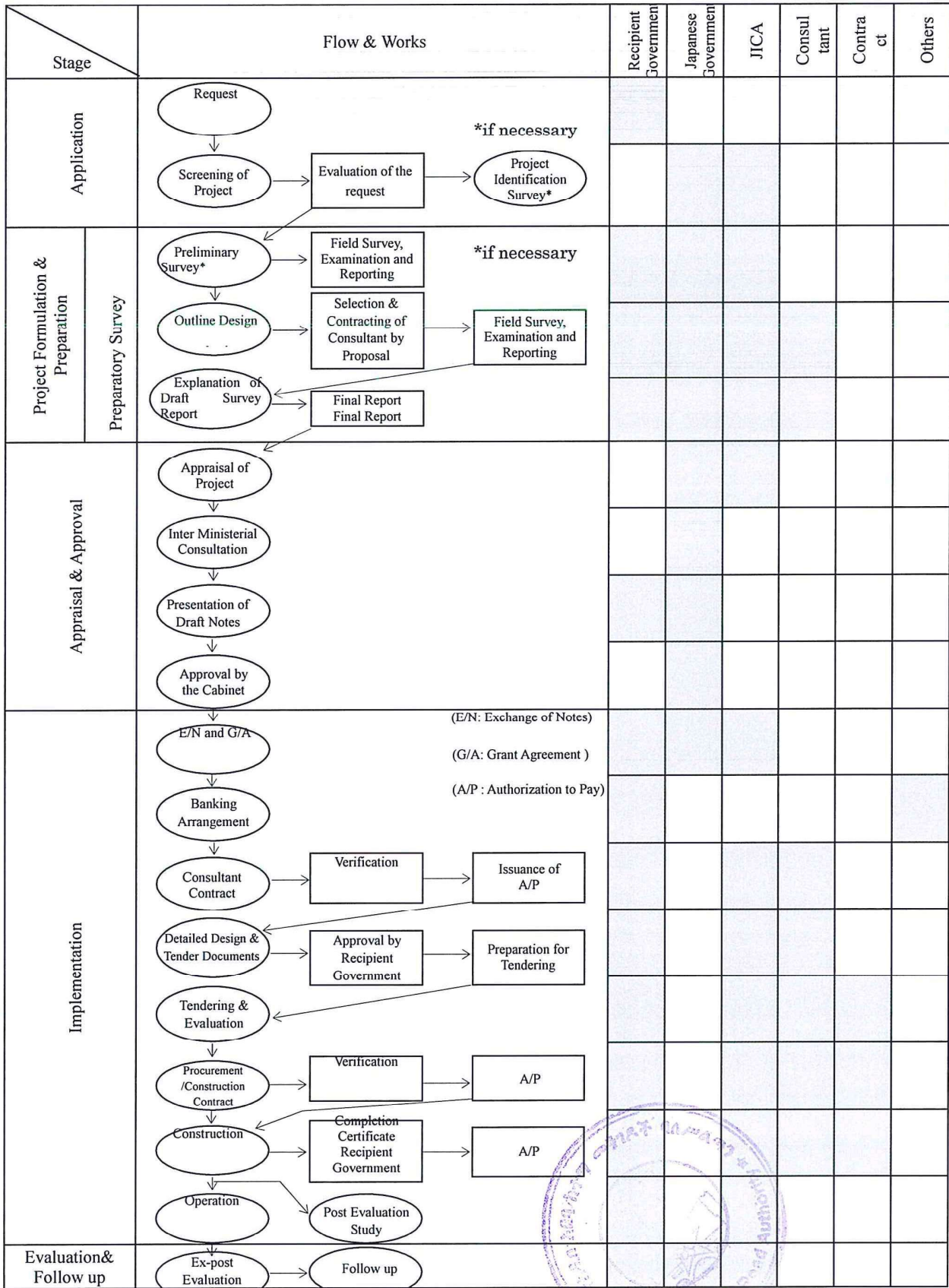


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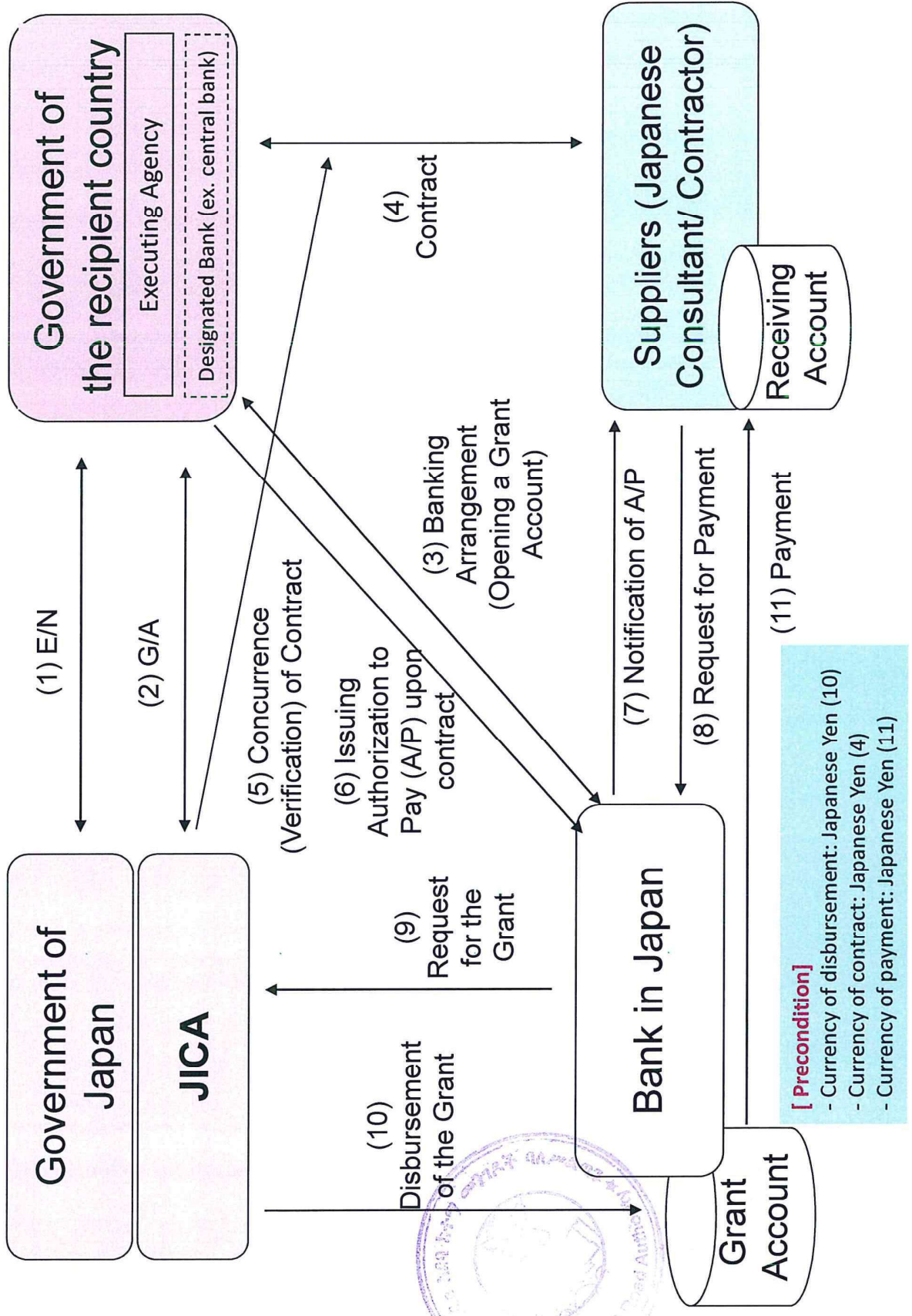
FLOW CHART OF JAPANESE GRANT PROCEDURES



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# Financial Flow of Japanese Grant (A/P Type)



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**Project Monitoring Report**  
**on**  
**Project Name**  
**Grant Agreement No. XXXXXXXX**  
20XX, Month

**Organizational Information**

<b>Signer of the G/A (Recipient)</b>	_____ Person in Charge (Designation) _____ _____ Contacts                      Address: _____ Phone/FAX: _____ Email: _____
<b>Executing Agency</b>	_____ Person in Charge (Designation) _____ _____ Contacts                      Address: _____ Phone/FAX: _____ Email: _____
<b>Line Ministry</b>	_____ Person in Charge (Designation) _____ _____ Contacts                      Address: _____ Phone/FAX: _____ Email: _____

**General Information:**

<b>Project Title</b>	
<b>E/N</b>	Signed date: Duration:
<b>G/A</b>	Signed date: Duration:
<b>Source of Finance</b>	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____



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**1: Project Description**

**1-1 Project Objective**

**1-2 Project Rationale**

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

**1-3 Indicators for measurement of "Effectiveness"**

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr )	Target (Yr )
Qualitative indicators to measure the attainment of project objectives		

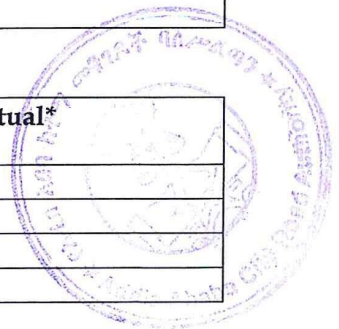
**2: Details of the Project**

**2-1 Location**

Components	Original <i>(proposed in the outline design)</i>	Actual
1.		

**2-2 Scope of the work**

Components	Original* <i>(proposed in the outline design)</i>	Actual*
1.		



Reasons for modification of scope (if any).

(PMR)

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**2-3 Implementation Schedule**

Items	Original		Actual
	<i>(proposed in the outline design)</i>	<i>(at the time of signing the Grant Agreement)</i>	

Reasons for any changes of the schedule, and their effects on the project (if any)

--

**2-4 Obligations by the Recipient**

**2-4-1 Progress of Specific Obligations**

See Attachment 2.

**2-4-2 Activities**

See Attachment 3.

**2-4-3 Report on RD**

See Attachment 11.

**2-5 Project Cost**

**2-5-1 Cost borne by the Grant(Confidential until the Bidding)**

Components	Cost (Million Yen)			
	Original <i>(proposed in the outline design)</i>	Actual <i>(in case of any modification)</i>	Original <sup>(1),2)</sup> <i>(proposed in the outline design)</i>	Actual
1.				
Total				

Note: 1) Date of estimation:  
 2) Exchange rate: 1 US Dollar = Yen

**2-5-2 Cost borne by the Recipient**

Components	Cost (1,000 Taka)			
	Original <i>(proposed in the outline design)</i>	Actual <i>(in case of any modification)</i>	Original <sup>(1),2)</sup> <i>(proposed in the outline design)</i>	Actual
1.				

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- Note: 1) Date of estimation:  
 2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

**2-6 Executing Agency**

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

<b>Original</b> (at the time of outline design) name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
<b>Actual</b> (PMR)

**2-7 Environmental and Social Impacts**

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

**3: Operation and Maintenance (O&M)**

**3-1 Physical Arrangement**

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

<b>Original</b> (at the time of outline design)
<b>Actual</b> (PMR)



**3-2 Budgetary Arrangement**

- Required O&M cost and actual budget allocation for O&M

**Original** (at the time of outline design)

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Actual (PMR)

**4: Potential Risks and Mitigation Measures**

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

**Assessment of Potential Risks (at the time of outline design)**

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

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	Contingency Plan (if applicable):
<b>Actual Situation and Countermeasures</b>	
(PMR)	

**5: Evaluation and Monitoring Plan (after the work completion)**

**5-1 Overall evaluation**

Please describe your overall evaluation on the project.

**5-2 Lessons Learnt and Recommendations**

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

**5-3 Monitoring Plan of the Indicators for Post-Evaluation**

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.



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Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant  
Appendix - Photocopy of Contractor's Progress Report (if any)
  - Consultant Member List
  - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
6. Pictures (by JPEG style by CD-R) (PMR (final) only)
7. Equipment List (PMR (final) only)
8. Drawing (PMR (final) only)
9. Report on RD (After project)



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Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)  
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	



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### Major Undertakings to be taken by the Government of Ethiopia

#### 1. Specific obligations of the Government of Ethiopia which will not be funded with the Grant

##### (1) Before the Bidding

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open bank account (B/A)	within 1 month after the signing of the G/A	[TBD]		
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract(s)	[TBD]		
	1) Payment commission for A/P	within 1 month after the signing of the consulting services agreement	[TBD]		
4	To submit the Project Monitoring Report (with the result of Detail Design)	before preparation of bidding document(s)	AACRA		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

##### (2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	[TBD]		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	[TBD]		
	2) Payment commission for A/P	every payment	[TBD]		
3	To secure and clear the sites for the garage of equipment and spare parts	before the delivery of equipment	AACRA		
4	To ensure prompt customs clearance and to assist the Supplier(s) with internal transportation in the country of the Recipient	during the Project	AACRA		
5	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	AACRA		
6	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted or	during the Project	[TBD]		

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	be borne by its designated authority without using the Grant;				
7	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	AACRA		
8	1) To submit the Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within one month after completion of each work	AACRA		
	2) To submit the Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	AACRA		
9	To submit a report concerning completion of the Project	within six months after completion of the Project	AACRA		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	AACRA		

**2. Other obligations of the Government of Ethiopia funded with the Grant**

NO	Items	Deadline	Amount (Million Japanese Yen)*
1	To procure equipment 1) To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country a) Marin (Air) transportation of the products from Japan to the country of the Recipient b) Internal transportation from the port of disembarkation to the project site 2) To provide equipment with installation and commissioning		/
2	To implement detailed design, bidding support and procurement supervision (Consulting Service)		
	Total		

\*The Amount is provisional. This is subject to the approval of the Government of Japan.



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