

The People's Republic of Bangladesh
Ministry of Environment, Forest and Climate Change
Department of Environment

**The Preparatory Survey for
the Project for the Improvement of
Equipment for Air Pollution Monitoring
in
the People's Republic of Bangladesh**

Final Report

November 2024

Japan International Cooperation Agency (JICA)

Nippon Koei Co., Ltd.
Nippon Koei Energy Solutions Co., Ltd.
Japan Weather Association

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrusted it to a Joint Venture (Lead Firm: NIPPON KOEI Co., Ltd., Consortium Members NIPPON KOEI ENERGY SOLUTIONS Co., Ltd., and JAPAN WEATHER ASSOCIATION).

The survey team engaged in extensive discussions with the officials concerned of the Government of the People's Republic of Bangladesh, and conducted field investigations. Following further studies in Japan, this report has been 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 deepest gratitude to the officials concerned of the Government of the People's Republic of Bangladesh for their invaluable cooperation and support extended to the survey team.

November, 2024

Takahiro Morita
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Summary

1. Background of the Project

The People's Republic of Bangladesh is a country located in South Asia, bordered by India and Myanmar, and facing the Bay of Bengal. The country has a total area of 147,000 km², which is about 40% of Japan's total area. The country is flat, with mountainous areas limited to the east. The climate is tropical monsoon, with a rainy season (June to October) and a dry season.

It became independent as a part of the country of Pakistan (East Pakistan) in 1947 and became independent as the People's Republic of Bangladesh in 1971. The population in 2022 was 169,828,911, and many of the top 10 most populous cities are located in the Dhaka and Chattogram regions. The city with the largest population is Dhaka South and North City (Dhaka City) with 15,210,851 people. According to the World Health Organization, the population is expected to increase by 25% between 2023 and 2050.

In 2023, the country's gross domestic product (GDP) was 437.42 billion US dollars, the GDP per capita was 2,529.1 USD, and the GDP growth rate was 5.8%. The main industries are textiles and clothing, which account for about 10% of GDP and more than 80% of exports. The service industry accounts for about half of the economy. On the other hand, agriculture is in decline, while industry is on the rise. When it gained independence in 1971, it was one of the poorest countries, but in 2015 it achieved the status of a lower-middle-income country. It is scheduled to be removed from the United Nations list of least developed countries (LDC) in 2026. The poverty rate (the percentage of people living on less than \$2.15 per day in 2017 purchasing power parity) fell from 11.8% in 2010 to 5.0% in 2022.

2. Result of the Survey and Contents of the Project

In Bangladesh, air pollution is becoming a serious problem due to factors such as the rapid increase in demand for transport accompanying economic growth. According to IQAir, the annual average PM_{2.5} for the whole country in 2023 was 79.9 µg/m³, making it the country with the most serious air pollution in the world. This figure exceeds the World Health Organization's air quality guideline value (5 µg/m³). It is estimated that around 159,000 people died in 2019 due to respiratory and heart diseases caused by air pollution (PM_{2.5} pollution in the environment and indoors), and there is a significant impact on the health of the people.

The Government of Bangladesh announced the “8th Five-Year Plan (July 2020 - June 2025)” in December 2020. According to the plan, the main environmental problem in Dhaka and Chattogram is air pollution. The main cause of air pollution is said to be the increase in the number of vehicles. The goal is to reduce the annual average of PM_{2.5} to 60µg/m³ by 2025, and the improvement of the air environment is positioned as an urgent issue.

In Bangladesh, measures to combat air pollution are being promoted with the support of the World Bank. As part of this support, the establishment of Continuous Air Quality Monitoring Stations (CAMS) has been promoted. On the other hand, there are no CAMS that have been set up to understand the impact of vehicle emissions. From this background, the Government of Bangladesh requested the Japan International Cooperation Agency to implement grant aid for the development of vehicle emission measurement stations to understand the impact of air pollution from vehicle emissions.

3. Outline of the Survey Results and Contents of the Project

At the request of the Government of Bangladesh, the Japan International Cooperation Agency (JICA) decided to conduct a feasibility study on cooperation for a project to provide equipment for monitoring air pollution in Bangladesh. A JICA Survey Team was sent to Bangladesh a total of six times between July 29, 2023, and October 5, 2024. The JICA Survey Team held discussions with the implementing agency, the Department of Environment, Ministry of Environment, Forest and Climate Change (DoE), and conducted field surveys in Dhaka and Chattogram, selected sites for the installation of Roadside CAMSs for measurement of vehicle emission, and provided support for

obtaining the consent of landowners at the selected sites for use.

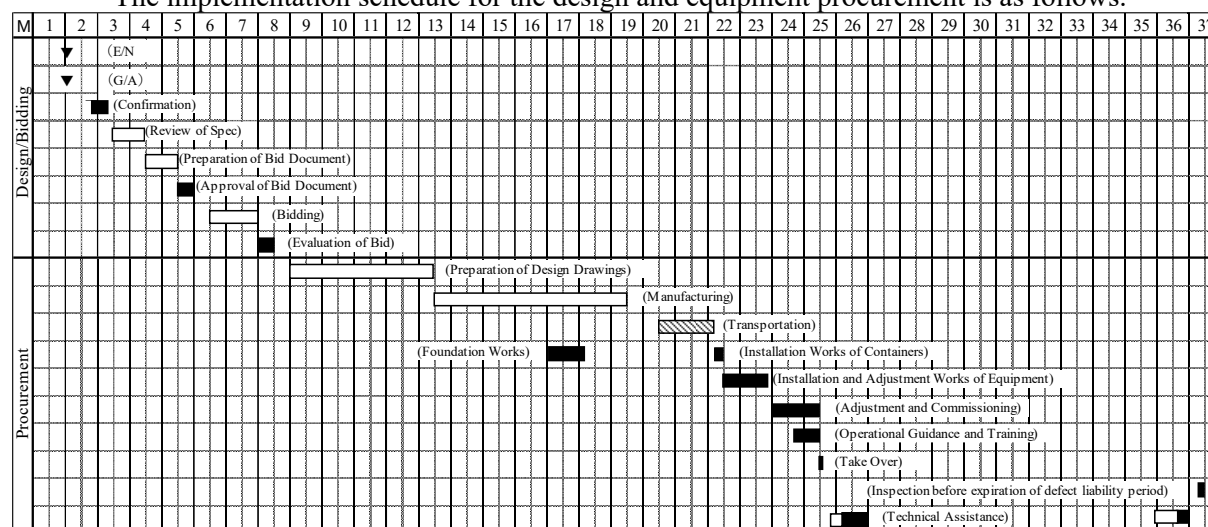
The project involves the procurement of equipment for the establishment of Roadside CAMSs, as well as the construction of the stations and installation of the equipment. The project components are as follows.

Contents of the Project

Item	Outline
Procurement Equipment	Air Pollution Measurement Instrument
	Calibration Equipment for Air Pollution Measurement Instrument
	Meteorological Observation Instrument
	Communication and Power Supply Instrument
	Containers for CAMS
	Facilities for CAMS
	Data Center Equipment
	Consumable and Replacement Parts, Spare Equipment
Installation	Installation Works, Operational Guidance
Consulting Services	Detailed Design, bidding support, Procurement Supervision
Soft component (Technical Assistance)	Development of the plan for preventive inspection and operation and maintenance (O&M). Enhancement of the capability on accuracy control and analysis of monitoring data.

4. Implementation Schedule and Project Cost Estimation

The implementation schedule for the design and equipment procurement is as follows.



The project cost to be borne by the Bangladesh side is roughly estimated at approximately 2.6 million Bangladesh taka.

5. Project Evaluation

(1) Relevance

The Government of Bangladesh has positioned the improvement of the atmospheric environment as an urgent issue in its 8th Five-Year Plan (2020/21-2024/25), setting a target of reducing PM_{2.5} concentrations (annual average) to 60 µg/m³ by 2025. Considering that there are no Roadside CAMSs currently in Bangladesh, it will be worthwhile and valid to install the Roadside CAMSs to monitor the effects of vehicle emissions.

Furthermore, Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC) drafted the “Dhaka City Air Pollution Control Action Plan (Dhaka City Blue Sky Action Plan)” in 2024. This action plan states that vehicle emission is one of the main causes of air pollution in Dhaka City and sets continuous air quality monitoring with the Roadside CAMSs as one of their action plans. The project aligns with this action plan as well.

(2) Effectiveness

The implementation of the project is expected to have the following quantitative and qualitative effects.

Expected Quantitative Effects by the Project

Effects	Current Situation (in 2023)	Target (in 2030/in three years after project completion)
Annual hourly data acquisition rate for each pollutant by the Roadside CAMS (hour/year ^{*1})	0	6,000
Publish an annual report of the data monitored with the Roadside CAMSs on the DoE website (times/year)	0	1 ^{*2}
The number of times the air quality data acquired through the project is used in measures such as air pollution control rules	0	1 ^{*3}

*1 The criteria for determining whether a station is an “effective station” for Japan's continuous observation are based on the reference time. The criteria are determined for each measurement item. The aim is to achieve continuous measurement at each of the seven new Roadside CAMSs to be established as part of the project. (On-vehicle CAMS is not included in the above table because their main purpose is to provide backup in the event of a breakdown, etc., and they do not measure at fixed points at all times.)

*2 Expecting to publish an annual report with data monitored in a year (Status of satisfaction of the environmental standards, study of seasonal fluctuations, etc.)

*3 It must be used in at least one measure by 2030.

Expected Qualitative Effects by the Project

Effects	Details
Improvement of the monitoring data quality of the Roadside CAMSs	Proper operation and maintenance will improve the monitoring data quality of the Roadside CAMSs.
Improvement of DoE's capacity to analyze the monitoring data with the Roadside CAMSs	DoE's capacity to interpret and analyze the monitoring data will be enhanced through the soft components.
Promoting the study of measures to combat Roadside air pollution based on air quality measurement results*	Lines and sections where air quality pollution countermeasures should be prioritized can be identified, and countermeasures can be considered.

* It can be achieved if the existing CAMSs data can be also taken into consideration in the upcoming JICA technical cooperation project

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Location Map



Source: JICA Survey Team based on Google Map (Map data©2023 Google)

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Abbreviation

Abbreviation	Meaning
A/P	Authorization to Pay
AIT	Advance Income Tax
APCR	Air Pollution Control Rules
AQI	Air Quality Index
AQMW	Air Quality Management Wing
B/A	Banking Arrangement
BCAP	Bangladesh Clean Air Project
BCSIR	Bangladesh Council of Scientific and Industrial Research
BEST Project	Bangladesh Environmental Sustainability and Transformation Project
BDS	Bangladesh Standard
BMD	Bangladesh Meteorological Department
BDT	Bangladesh Taka
CAMS	Continuous Air Monitoring Station
CASE Project	Clean Air and Sustainable Environment Project
C-CAMS	Compact Continuous Air Monitoring Station
CDA	Chattogram Development Authority
CO	Carbon Monoxide
DNCC	Dhaka North City Corporation
DG	Director General
DoE	Department of environment
DPP	Development Project Proposal
DSCC	Dhaka South City Corporation
DWASA	Dhaka Water Supply and Sewerage Authority
GDP	Gross Domestic Product
E/N	Exchange of Note
ECA	Environmental Conservation Act
ECC	Environmental Compliance Certificate
ECNEC	Executive Committee of the National Economic Council
ECR	Environmental Conservation Rules
ERD	Economic Relation Divisions
FID	Financial Institutions Division
FOIP	Free and Open Indo-Pacific
G/A	Grant Agreement
GDP	Gross Domestic Product
GHG	Greenhouse Gas
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IMF	International Monetary Fund
IP	Internet Protocol
ITU	International Telecommunication Union
JCSS	Japan Calibration Service System
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
JPY	Japanese Yen
LAN	Local Area Network
LDC	Least Development Country
LGD	Ministry of Local Government, Rural Development and Co-operatives, Local Government Division
LTE	Long Term Evolution
MoEFCC	Ministry of Environment, Forest and Climate Change
MoF	Ministry of Finance
MoHPW	Ministry of Housing and Public Works

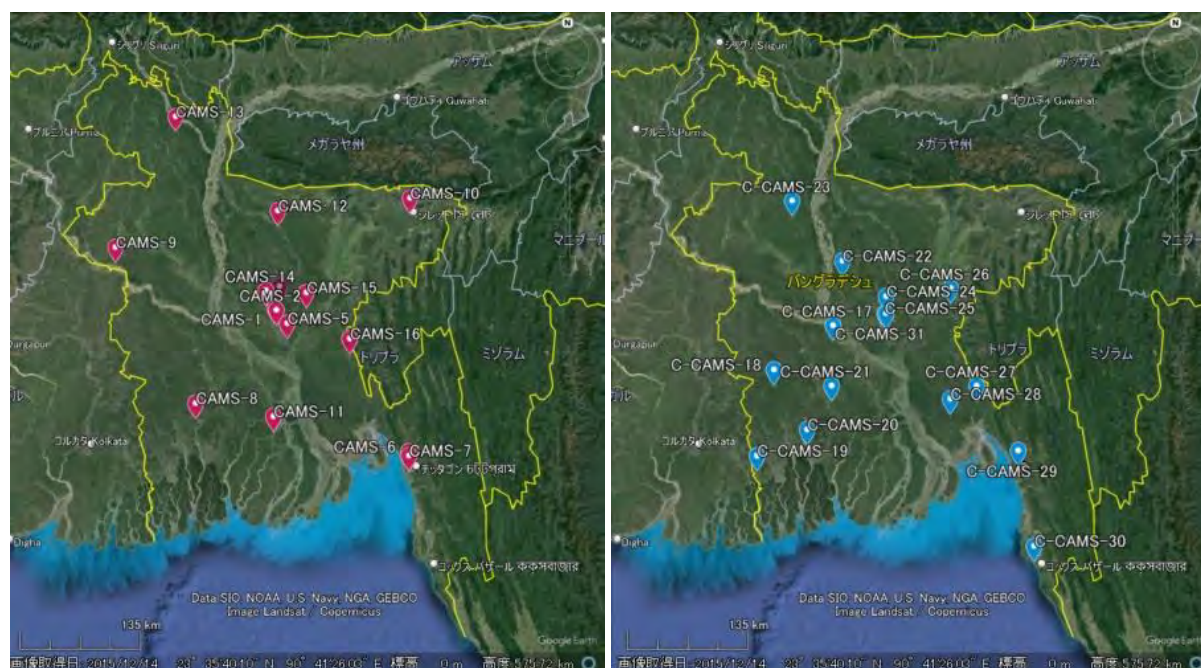
Abbreviation	Meaning
MoP	Ministry of Planning
MoST	Ministry of Science and Technology
NO	Nitric Oxide
NO ₂	Nitrogen Dioxide
NTC	Negative Temperature Coefficient
O ₃	Ozone
OJT	On-the-Job Training
PM	Particulate Matter
RAJUK	Rajdhani Unnayan Kartripakkha
RH	Relative Humidity
RHD	Roads and Highways Department of the Ministry of Road Transport and Bridges
RTHD	Ministry of Road Transport and Bridges, Road Transport and Highway Division
SBC	Sadharan Bima Corporation
SO ₂	Sulfur Dioxide
TTB	Telegraphic Transfer Buying Rate
TTS	Telegraphic Transfer Selling Rate
USD	United States Dollar
UPS	Uninterruptible Power Supply
VAT	Value Added Tax
VPN	Virtual Private Network
WAN	Wide Area Network
WHO	World Health Organization

Chapter 1 Background of the Project

1-1 Project Background

Air pollution in Bangladesh is becoming increasingly serious due to the rapid increase in traffic and other factors associated with the country's economic growth. The particulate matter (PM_{2.5}) concentration (annual average for the entire country in 2023) was 79.9 µg/m³, far exceeding the air quality guideline value (5 µg/m³) set by the World Health Organization, and the country is considered to suffer from the most serious air pollution in the world (IQAir, 2023). It is estimated that about 159,000 people died in the country in 2019 due to respiratory and cardiac diseases caused by air pollution, and the health of the people has been severely affected (World Bank, 2023). Black carbon, which is one of the components of PM_{2.5}, has 460-1,500 times more greenhouse effects than carbon dioxide (CO₂) in general.

The Government of Bangladesh has set air pollution as an urgent issue in its 8th Five-Year Plan (2020/21-2024/25), setting a target of reducing PM_{2.5} concentrations (annual average) to 60 µg/m³ by 2025. The plan states that it is necessary to develop measurement equipment and databases, strengthen the monitoring system, and work on necessary policy and institutional planning. Although 16 Continuous Air Quality Monitoring Stations (CAMSSs) and 15 Compact Continuous Air Quality Monitoring Stations (C-CAMSSs) have been established throughout the country with the support of the World Bank as shown in Figure 1-1, there are no CAMSSs specifically designed to monitor the effects of air pollution derived from vehicle emissions, which is considered as one of the major sources of air pollutants including PM_{2.5} in an urban area. As a result, it is not yet possible to measure and analyze the data necessary to formulate appropriate environmental policies related to vehicle emissions.



Note: Left: CAMSSs, Right: C-CAMSSs

Source: JICA Survey Team based on Google Earth (Data: SIO, NOAA, United States Navy, NGA, GEBCO. Image Landsat/Copernicus)

Figure 1-1 Location of CAMSSs and C-CAMSSs

Table 1-1 shows the top ten districts with the most population in Bangladesh. The most populous city is Dhaka City, followed by Chattogram City. Most of them are in the Dhaka Division or Chattogram Division. Dhaka Division has several districts with high population density and many roads with chronic traffic congestion. Although most districts in the Chattogram Division have a lower population density compared with those in the Dhaka Division, there are still some roads that experience chronic traffic congestion. This is mainly because Chattogram Port handles 98% of

containers in Bangladesh; and the steel industry, especially processing of scrap iron using electric furnaces, is thriving in Chattogram, leading to a significant number of heavy-duty vehicles on the roads.

Table 1-1 Top Ten Districts in Bangladesh with Population and their Densities

Division	District	Population (2022)	Population Density (ppl/km ²)
Dhaka	Dhaka	15,210,851	10,390
Chattogram	Chattogram	9,439,076	1,787
Chattogram	Cumilla	6,394,875	2,033
Mymensingh	Mymensingh	6,097,814	1,387
Dhaka	Gazipur	5,433,538	3,009
Dhaka	Tangail	4,168,083	1,221
Dhaka	Narayanganj	4,035,461	5,900
Sylhet	Sylhet	3,990,003	1,156
Rajshahi	Bogra	3,815,192	1,316
Chattogram	Noakhali	3,732,042	1,012

Source: JICA Survey Team based on City Population, <https://www.citypopulation.de/en/bangladesh/cities/>

Figure 1-2 and Figure 1-3 show the traffic conditions in Dhaka and Chattogram. Some vehicles emitting black smoke were observed in Dhaka and Chattogram as shown in Figure 1-4.



Source: JICA Survey Team

Figure 1-2 Traffic Conditions in Dhaka



Source: JICA Survey Team

Figure 1-3 Traffic Conditions in Chattogram



Source: JICA Survey Team

Figure 1-4 Black Smoke Emissions from Vehicles (Left: Dhaka, Right: Chattogram)

Under these conditions, the Government of Bangladesh requested JICA for a grant aid project, where CAMSs will be installed on the roadsides (hereinafter referred to as “Roadside CAMSs”) to monitor the ambient air quality and understand the level of impacts of vehicle emissions. Therefore, “the Project for the Improvement of Equipment for Air Pollution Monitoring” (hereinafter referred to as “the project”) is intended to address the development agenda mentioned above by contributing to the enhancement of the capacity to measure and analyze air pollutants derived from vehicle emissions. Ultimately, it will contribute to the enhancement of air pollution control capacity, through the development of Roadside CAMSs for understanding the effects of vehicle emissions.

In the Preparatory Survey for the Project for the Improvement of Equipment for Air Pollution Monitoring (hereinafter referred to as “the survey”), the JICA Survey Team examined the validity and effectiveness of the grant aid project, created appropriate detailed design and plans for the grant aid project, and estimated the project costs.

1-2 Project Outline

Table 1-2 shows the project outline.

Table 1-2 Project Outline

Item	Contents
Project Objectives	To develop Roadside CAMSs for a better understanding of the effects of vehicle emissions as well as contributing to enhancing DoE’s capacity to measure, analyze, and control air pollution caused by vehicle emissions.
Assistance Components	1) Equipment Roadside CAMSs <Fixed CAMSs: 7 (5 in Dhaka City, 2 in Chattogram City), On-vehicle CAMS: 1>, Data Center Equipment (e.g., workstation) * Monitoring Items: 7 (CO, NO, NO ₂ , SO ₂ , PM _{2.5} , PM ₁₀ , O ₃) 2) Consulting Services Detailed design, bidding support, procurement supervision 3) Soft component (Technical Assistance) Development of the plan for preventive inspection and operation and maintenance (O&M). Enhancement of the capability of accuracy control and analysis of monitoring data.
Project Site	Dhaka City and Chattogram City
Implementing Agency	Department of Environment (DoE), under the Ministry of Environment, Forest and Climate Change (MoEFCC)

Source: JICA Survey Team

1-3 Natural Conditions

The meteorological conditions for Dhaka City and Chattogram City, the target sites for this project, are shown in Table 1-3. All figures below are calculated based on meteorological data from 2012 to 2021.

Table 1-3 Meteorological Condition of Dhaka and Chattogram

City	Temperature (°C)			Humidity (%)			Rainfall (mm)			Wind Speed (km/h)	
	Max of Month Ave	Min of Month Ave	Ave of Year	Ave of Year	Max of Month Ave	Min of Month Ave	Ave of Year	Max Monthly Accumulation	Min Monthly Accumulation	Max of Ave	Min of Ave
Dhaka	34	15	27	71	80 (Jul, Aug)	57 (Feb, Mar)	1,930	427 (Jul)	10 (Jan, Feb)	11 (Apr)	3 (Nov)
Chattogram	33	15	27	74	85 (Jul)	61 (Feb)	3,000	854 (Jul)	5 (Jan, Feb, Dec)	23 (Jul)	10 (Nov)

Source: JICA Survey Team

Since the annual precipitation is about 2,000 to 3,000 mm, the Roadside CAMS building must be adequately waterproofed and protected against flooding. In addition, because the humidity in Bangladesh is high, the interior of the Roadside CAMSs will need to be adjusted using air conditioning, in consideration of the effect on the measuring instruments.

1-4 Environment and Social Considerations

The project is classified as Category C, defined in the “JICA Guidelines for Environmental and Social Considerations” since its potential adverse effects on the environment and society will be minimal, and the project is not in the ‘vulnerable sectors or locations’ group. Therefore, based on the JICA guideline, the environmental and social considerations process is completed at this point. However, if any major environmental and social impacts arise later, the category will be reconsidered, and an environmental review will be conducted accordingly.

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Overall Goal

The ability to address air pollution will be strengthened in Bangladesh.

2-1-2 Project Purpose

The capacity to measure and analyze air pollutants from vehicle emissions will be strengthened in Dhaka and Chattogram cities.

2-1-3 Outline of the Project

In order to achieve the above-mentioned goal and purpose, the project will install five Roadside CAMSs in Dhaka, two in Chattogram, and one on-vehicle CAMS, as well as a Data Center Equipment to monitor the data from these Roadside CAMSs. The Roadside CAMSs will be installed along roads with heavy traffic, and the items to be measured will be 7 items (CO, NO, NO₂, SO₂, PM_{2.5}, PM₁₀, O₃).

The project also includes consulting services for detailed design, bidding support, procurement supervision, and equipment installation supervision. In this consulting service, a soft component (technical assistance) will also be implemented to guide the development of the plan for preventive inspection and operation and maintenance (O&M) for Roadside CAMSs, and on the enhancement of the capability on accuracy control and analysis of monitoring data.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

The project will make it possible to accurately understand the status of air pollution originating from vehicle emissions in Bangladesh. The project will also develop an implementation plan for the smooth and efficient establishment of the Roadside CAMSs through prompt procurement and optimal procedures, to help to improve air quality.

The project will be implemented as part of air quality improvement in Bangladesh. Since vehicle emission is mainly a problem in urban areas and scattered measurement stations would reduce operational efficiency, the project will target large cities. In addition, since the existing CAMSs, which the World Bank supported its installation, is operated by DoE to monitor general environmental air quality conditions, the specifications of the equipment to be developed for the project should be reasonably consistent with the measurement items and measurement accuracy.

2-2-1-1 Basic Policies

Based on the request from the counterpart country and the results of the survey, the basic policies were formulated as follows:

- ✓ Seven fixed CAMSs and one on-vehicle CAMS for backup purposes will be installed as Roadside CAMSs. In addition, Data Center Equipment such as workstations will be installed.
- ✓ The fixed CAMSs will be installed in Dhaka City and Chattogram City, which have large population densities and traffic volumes. The sites will be located along major arterial roads for a better understanding of the effects of vehicle emissions, and on government land that does not require land acquisition.
- ✓ The Data Center Equipment for data aggregation and monitoring of the Roadside CAMSs will be installed at DoE's existing data center.
- ✓ The measurement items to be determined at Roadside CAMSs will include seven items for which environmental standards have been set, namely, NO₂, SO₂, PM_{2.5}, PM₁₀, O₃, CO,

and NO. In addition, meteorological observation items, namely wind direction and speed, temperature, humidity, and precipitation will also be incorporated.

- ✓ The air pollutant measurement equipment will automatically measure the concentration of air pollutants at regular intervals. In order to maintain measurement accuracy, calibration using calibration gas and calibration equipment shall be performed periodically.
- ✓ The meteorological measurement equipment shall automatically measure meteorological observation items at regular intervals.
- ✓ Fixed and on-vehicle CAMSs shall be equipped with data loggers and terminals (PCs) to collect, store, display, correct, and transmit measurement data to the Data Center Equipment.
- ✓ Fixed and on-vehicle CAMSs shall be housed in a building, which shall be equipped with air pollutant measurement equipment, calibration equipment, calibration gas, meteorological measurement equipment, power supply equipment, communication equipment, air conditioning equipment, ventilation equipment, and lighting equipment.
- ✓ The on-vehicle CAMS shall be installed on the back of a vehicle, which can be transported by the vehicle.

2-2-1-2 Policies on Climate

Many of the air pollution measurement instruments procured for the project are set to operate in temperature conditions of 0 to 40°C. In addition, many of them are set to operate in humidity conditions of 85% RH (Relative Humidity) or less.

Therefore, air conditioners will be installed in the building where the air pollution measurement instruments will be installed, so that the indoor temperature and humidity will be kept within the temperature and humidity conditions of the instruments.

Furthermore, in consideration of natural disasters such as earthquakes, the policy is to construct a foundation and anchorage for the building where the air pollution measurement instruments will be installed.

2-2-1-3 Policy on Applicable Standards

For equipment procured in Japan under the project, the International Electrotechnical Commission (IEC) and Japanese Industrial Standards (JIS) will be applied as a basis. For equipment procured in Bangladesh, the Bangladesh Standard (BDS) will be applied in addition to IEC, JIS, and standards of other developed countries.

2-2-1-4 Policies on Social Economy

2-2-1-4-1 Religion and Traditions

Islam is the major religion in Bangladesh. The project schedule must be planned considering religious and traditional events, such as Ramadan or Eid holidays.

2-2-1-4-2 Gender Mainstreaming

There seem to be no specific goals or rules related to gender equality within the air pollution control policies in Bangladesh. Although Bangladesh has ratified the Convention on the Elimination of All Forms of Discrimination against Women, gender equality has not been fully achieved on a national scale; for example, some women's rights, such as inheritance rights or freedom of choice in marriage, are not yet accepted. The government established the Ministry of Women and Children Affairs and adopted the national policy for women's empowerment in 1997. The national policy contains 'political, social, government, and economic empowerment of women'. In 1998, the government adopted a National Action Plan to address gender inequality and strengthen women's rights in all areas of society. After the Fourth Five-Year Plan, all the national five-year plans mention women's employment, and the latest one (the Eighth Five-Year Plan) states 'to be a country where men and women have equal opportunities and rights, and women are accepted as equal contributors

in economic, social, and political development’.

There are two deputy directors in the section in charge of air pollution control in DoE, and one of them is a woman. There seems not to be an inequality for women in DoE, such as in their status or decision-making. According to DoE, the percentage of female staff in DoE accounts for about 30% as of August 2023. There are 31 staff for the maintenance of existing CAMSs, about seven of them are women. DoE is willing to assign female staff for the Roadside CAMS maintenance, and the technical assistance components will be designed considering equal opportunities for men and women in the project.

2-2-1-5 Policies on the Local Business Style, Construction, and Procurement

The air pollutant measurement equipment is not manufactured in Bangladesh, and there are two Japanese suppliers that manufacture the air pollutant measurement equipment and have overseas operations. Taking these circumstances into account, the equipment from these two suppliers will be selected. Other equipment will be procured from suppliers in Bangladesh from the viewpoint of maintenance and operation.

Although containers for Roadside CAMSs, mentioned in 2-2-2-2, are manufactured in third countries such as India. It is necessary to ensure the quality described in the basic design policy, it was determined that the containers should be procured from Japan based on interviews with the manufacturers.

Materials and equipment that will be used to build the foundation for installing the Roadside CAMSs such as concrete and reinforcing bars can be procured in Bangladesh.

2-2-1-6 Policies on the Selection of Local Agencies

For the operation and maintenance after the Project, the priority policy is to outsource local private companies, including existing CAMSs maintenance contractors, for the sake of expeditiousness and sustainability. However, in the future, DoE will need to plan for maintenance management by the DoE staff in order to implement maintenance management efficiently from the DoE's budgetary perspective.

In addition, manufacturers who have sales agents in the local and neighboring countries will be given priority for inspections and troubleshooting of the measurement equipment.

The following are the operations and maintenance contractors of existing CAMSs and sales agents of Japanese measurement equipment manufacturers, who can be involved in carrying out this project.

2-2-1-6-1 Operation and Maintenance Contractors

The operation and maintenance of the Roadside CAMSs and measurement equipment are generally outsourced to specialized companies in Japan due to their complexity and the expertise required. When outsourcing, it is necessary to consider the scope of works to be outsourced, the selection of outsourcing companies, the implementation plan for the outsourced works, and the supervision of the outsourced works.

Since the personnel in charge of existing CAMSs and C-CAMSs transfer within a short period of time (about three years), DoE does not have the necessary knowledge of operation and maintenance. Therefore, DoE outsources the operation and maintenance of existing CAMSs and C-CAMSs to Advance Scientific Instrument Consortium (ASIC) and Eutech Systems Limited (Eutech). The DoE's criteria for selecting operation and maintenance companies include technical capabilities, maintenance details, services, fees, academic backgrounds, track record, and parent company approvals.

The JICA Survey Team went to ASIC and Eutech to learn about the operation and maintenance status of existing CAMSs and C-CAMSs through interviews. A summary of the interviews is described below.

(1) Advance Scientific Instrument Consortium

Since 2006, ASIC has been in charge of operating and maintaining existing CAMSs. It is responsible for the nine existing CAMSs, including Dhaka (one station) and Chattogram (one station). ASIC also operates and maintains all existing C-CAMSs (15 stations). The manufacturer of the air pollutant measurement equipment operated and maintained by ASIC is ENVEA, while the manufacturer of the meteorological instruments is LSI LASTEM.

ASIC has 22 employees and nine of them are responsible for the operation and maintenance of existing CAMSs (one person per station). These nine personnel majored in Environmental Science and Environmental Management.

(2) Eutech Systems Limited

Eutech Systems Limited is a young company founded in 2018. The company monitors not only the atmospheric environment, but also water and soil quality, oceanographic observations, and drone-based observations.

Since February 2021, Eutech has been tasked with the operation and maintenance of existing CAMSs that DoE has commissioned. They are in charge of seven existing CAMSs, including two in Dhaka and one in Chattogram. Eutech is not responsible for operating or maintaining existing C-CAMSs. The location of existing CAMSs and their number of operations and maintenance are unchanged.

Of Eutech's 25 employees, seven are designated to operate and maintain existing CAMSs (one person per station). One of the employees has a degree in physics, and has worked for 12 years in the operation and maintenance of existing CAMSs, including junior engineer roles on the World Bank CASE project.

2-2-1-6-2 Distributors of Measurement Equipment

The JICA Survey Team conducted interviews with overseas sales agents of two Japanese measurement equipment manufacturers to ensure that it is easy to obtain consumables and spare parts needed for the operation and maintenance of measurement equipment and that necessary technical services such as periodic inspections are available in Bangladesh.

The survey method was face-to-face for the company with a sales agent in Bangladesh, while a questionnaire was sent to the company without a sales agent in Bangladesh to obtain responses.

The results of interviews with distributors are described below.

(1) Company X

Company X is a sales agent in Bangladesh of Company A's group company in India. The company has 24 technicians who inspect and calibrate measurement equipment and meteorological equipment. These technicians are trained by Company A's group company in India.

(2) Company Y

Company Y is an Indian distributor for Company B. The company has its headquarters located in Z state, India, and also has multiple locations. On-site user training and training workshops are held by the company periodically to ensure reliable operation and maintenance of its systems by its customers as part of its ongoing commitment to user training. Ten technicians inspect and calibrate air pollutant measurement equipment and meteorological equipment.

2-2-1-7 Policies on the Selection of Japanese Enterprises

2-2-1-7-1 Procurement of Measurement Equipment

In terms of the selection of Japanese companies, it is assumed that Japanese companies will be selected as manufacturers of air pollution measurement equipment for the project. Japanese manufacturers possess advanced technologies refined in response to social demands for monitoring

serious air pollution caused by Japan's economic growth. Contributing to the development of developing countries with excellent technologies possessed by the Japanese private sector through the promotion of environmental infrastructure exports would be in line with JICA's Global Agenda (issue-specific business strategies) 18. Environmental Management - JICA Clean City Initiative - Issue-Specific Objectives.

2-2-1-8 Policies on Operation and Maintenance

2-2-1-8-1 Organization and Personnel

(1) Implementing Agency

The policy for operation and maintenance will be the same as that for the existing CAMSs and C-CAMSs, and DoE will assign at least one staff member to each CAMS to be in charge of maintenance. In addition, the DoE headquarters will manage the Roadside CAMSs to be installed in Dhaka City, and the DoE Chattogram Lab will manage the Roadside CAMSs to be installed in Chattogram City.

(2) Finances and Budget

Based on the interviews, DoE is struggling with the increasing operation and maintenance costs and is currently unable to purchase all of the replacement parts needed to keep the measurement equipment in operation. Therefore, in order to ensure that operation and maintenance can be carried out on a sustainable basis, the policy of the project's soft component is to clarify the costs of maintenance and management that will arise as a result of this project, and to formulate a budget plan for the future.

(3) Technical Level

DoE outsources most of the works required to operate and maintain existing CAMSs and C-CAMSs to two private maintenance companies. DoE visits existing CAMSs and C-CAMSs twice a month to witness the inspection works performed by the maintenance companies. Technical training for the DoE staff is needed, as the DoE is not able to manage and supervise some of its work, which is mainly performed by contractors.

DoE conducts routine inspections and purchases consumables for the measurement equipment on a regular basis. DoE has not made a plan sheet required for the proper operation and maintenance of the measurement equipment and there has been no action or plan to prevent breakdowns or missing measurements of the measurement equipment.

Based on the above, as technical assistance in this project, a maintenance and inspection procedure manual and equipment management procedure manual necessary for the operation and maintenance of the Roadside CAMSs will be developed, as well as a data screening procedure manual and data analysis procedure manual to improve accuracy control and analysis techniques of measurement data. The project will also develop a data screening procedure and data analysis procedure to improve the accuracy control of measurement data and analysis techniques.

2-2-1-9 Policies on the Grade of the Facilities and Equipment

2-2-1-9-1 Measurement Equipment

The grade of equipment to be procured for air quality and meteorological measurement equipment to be installed at the Roadside CAMSs to be provided under the Project is expected to be as accurate as the existing CAMSs and C-CAMSs installed by the World Bank and will include Japan's cutting-edge technology.

2-2-1-10 Policies on Construction Process

The project requires the construction of foundations for the installation of containers. These works are not complicated and can be adequately handled by companies in Bangladesh. The project will also consider the period of foundation construction in consideration of the procurement and transportation period of the equipment, and will plan for an efficient process and construction period.

2-2-1-11 Policies on Construction Management

In the project, the process is to install the containers on the constructed foundation, followed by the installation of equipment and adjustment work. The installation of the containers will require construction vehicles such as cranes to lift the containers, and sufficient plans will be made to secure the delivery routes and safety measures at the construction site.

2-2-1-12 Policies on Safety Management

Safety equipment (barricades, color cones, revolving lights, etc.) will be placed around the construction site to ensure safety. In addition, since construction vehicles will be passing through the construction site, no-entry signs and construction information boards will be installed at the construction site to inform landowners and local residents in order to ensure safety and prevent problems from occurring.

2-2-2 Basic Plan (Construction Plan/Equipment Plan)

2-2-2-1 Overall Plan

Considering the requests from DoE, site selection, and the necessity of the on-vehicle CAMS, the overall plan of the project is to install seven fixed CAMSs and one on-vehicle CAMS in Dhaka and Chattogram, and to provide consulting services and soft component (technical assistance).

2-2-2-1-1 Requests from DoE

DoE agreed to focus on Dhaka and Chattogram to install the Roadside CAMSs in the project. Besides, DoE requested for the following:

- ✓ Roadside CAMSs (fixed CAMSs): Six stations
 - ✓ Consulting services: Detailed design, bidding support, procurement supervision
 - ✓ Technical assistance: Introduction to the Roadside CAMS operation and maintenance
- DoE also requested to include an on-vehicle CAMS.

2-2-2-1-2 Site Selection of the Fixed CAMSs

First in the site selection, based on the desk survey, site survey, and discussion with DoE, potential areas with severe air pollution due to vehicle emissions were selected. Then, since government lands will be used for the sites in this project, 24 government lands (19 for Dhaka and 5 for Chattogram) were selected as candidate sites to install the Roadside CAMSs within the potential areas, considering space availability, site security, and access to electricity and the network. Table 2-1 shows the points to be considered in the site selection.

Figure 2-1 shows the site survey and Figure 2-2 shows the discussions with DoE for site selection.

Table 2-1 Points to be Considered in the Site Selection

Items	Details
Distribution of the Existing CAMSs	In order not to install the new CMASs in the same areas as the existing CAMSs, the JICA Survey Team confirmed if there are any CAMSs already working as Roadside CAMS.
Traffic Conditions	Based on the traffic volume, average speed, heavy vehicle percentage, and transportation development plans, potential areas with long-term air pollution due to vehicle emissions were selected.
Surroundings	Considering the buildings (building height, the number of schools and hospitals) and road structures (number of lanes, flyover) around the candidate sites, potential areas with severe air pollution due to vehicle emissions were selected. Then, space availability, site security, and access to electricity and the network were confirmed at the site to consider the possibility of installing the Roadside CAMSs.
Air Pollution	At the candidate sites selected through desk survey and discussion with DoE, the JICA Survey Team conducted preliminary air quality monitoring to get reference values of NO _x and PM concentrations.

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2-1 Site Survey to Investigate the Traffic Conditions, Surroundings, and Air Pollution, in the Potential Areas with Severe Air Pollution Due to Vehicle Emissions



Source: JICA Survey Team

Figure 2-2 Discussion with DoE to Select the Candidate Sites for the Roadside CAMSs

As a result of the discussions with the landowners at each candidate site, DoE has got agreements with the landowners at seven sites to install fixed CAMSs as shown in Table 2-2. DoE requested six fixed CAMSs as shown in the minutes of discussion (M/D) of the outline design survey, expecting five in Dhaka and one in Chattogram based on the scale of the cities. However, for the following two reasons, the JICA Survey Team has decided that it is valid to install fixed CAMSs at all seven sites:

- ✓ There were five candidate sites in Chattogram, and DoE could not obtain an agreement to install the Roadside CAMSs at the one in the city center. It is not ideal enough to represent the environment in Chattogram with one site apart from the city center.
- ✓ The two sites that were agreed to be used in Chattogram City are located north-south in the central area of the city and are evenly distributed. Moreover, it makes sense to measure at both sites since the northern site is along the main road leading to the Chittagon Hills while the southern site is along the main road leading to the Chittagon Port.

Table 2-2 List of Fixed CAMSs Installation Sites

No.	City	Road	Address	Landowner	Ministry
1	Dhaka (Dhaka North)	Dhaka–Mymensingh Highway (N3)	Sector 8, Uttra, Dhaka - Mymensingh Hwy, Dhaka	SBC	FID
2		Bir Uttam Rafiqul Islam Avenue	Hatirjheel Bridge, Hatir Jheel Link Rd, Dhaka	DWASA	LGD
3		Dhaka–Mymensingh Highway (N3), Dhaka Elevated Expressway	Road No. 27, Block-A, Dhaka - Mymensingh Highway, Dhaka	RHD	RTHD
4	Dhaka (Dhaka South)	Mirpur Road, New Elephant Road	Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka	BCSIR Dhaka	MoST
5		Jatrabari Road, Mayor Mohammed Hanif Flyover	Dhaka-Chattogram Highway, N1, Jatrabari Intersection	DSCC	LGD
6	Chattogram	M. A. Aziz Road	M. A Aziz Road, Saltgola, Chattogram	CDA	MoHPW
7		Chittagong-Hathazari-Rangamati Road (N106)	Chattogram Cantonment, Chattogram-4220	BCSIR Chattogram	MoST

Source: JICA Survey Team

Figure 2-3 shows the distribution of installation sites in Dhaka City and Figure 2-4 shows the distribution of installation sites in Chattogram City.



Source: JICA Survey Team based on Google Map (Map data©2024 Google)

Figure 2-3 Roadside CAMSs Installation Sites in Dhaka



Source: JICA Survey Team based on Google Map (Map data©2024 Google)

Figure 2-4 Roadside CAMSs Installation Sites in Chattogram

2-2-2-1-3 Validity and Operation Plan of the On-vehicle CAMS

As a result of the survey on the operation of the existing CAMSs, the following are the reasons why monitoring data contains lots of missing data:

- ✓ Two of the existing CAMSs had to be relocated since the landowners were ordered to do so, which led to missing data for over a year.
- ✓ When the monitoring devices malfunctioned, missing data occurred over a month during parts procurement and repair.
- ✓ There are some obvious abnormal values in the monitoring data, even when the data is not missing.

When missing data or abnormal data occurs for a long time, an on-vehicle CAMS can be used as a backup monitoring station in order to minimize data deficiency. If any of the monitoring points have to be relocated due to changes in the traffic conditions and land use since a number of large development and transportation infrastructure improvements are planned in Dhaka and Chattogram, the on-vehicle CAMS can be utilized to find the next locations to install the Roadside CAMSs. Moreover, if measurements are taken near the border, it can be utilized to assess the impact of

transboundary pollution. Considering those situations, it is valid to install an on-vehicle CAMS in Bangladesh. The on-vehicle CAMS will be installed in the DoE Headquarters.

After installation of the on-vehicle CAMS, this must keep working even at the storage site, because it is supposed to start monitoring as a backup station, as soon as possible, at a site where missing data or abnormal data is expected to be inevitable for a long time. Considering the climate in Bangladesh, an air conditioner must be running at least all day. The operation cost can be saved, for example by reducing the frequency of operations, but it should be considered after the model of the monitoring devices have been decided accordingly.

2-2-2-2 Equipment Plan

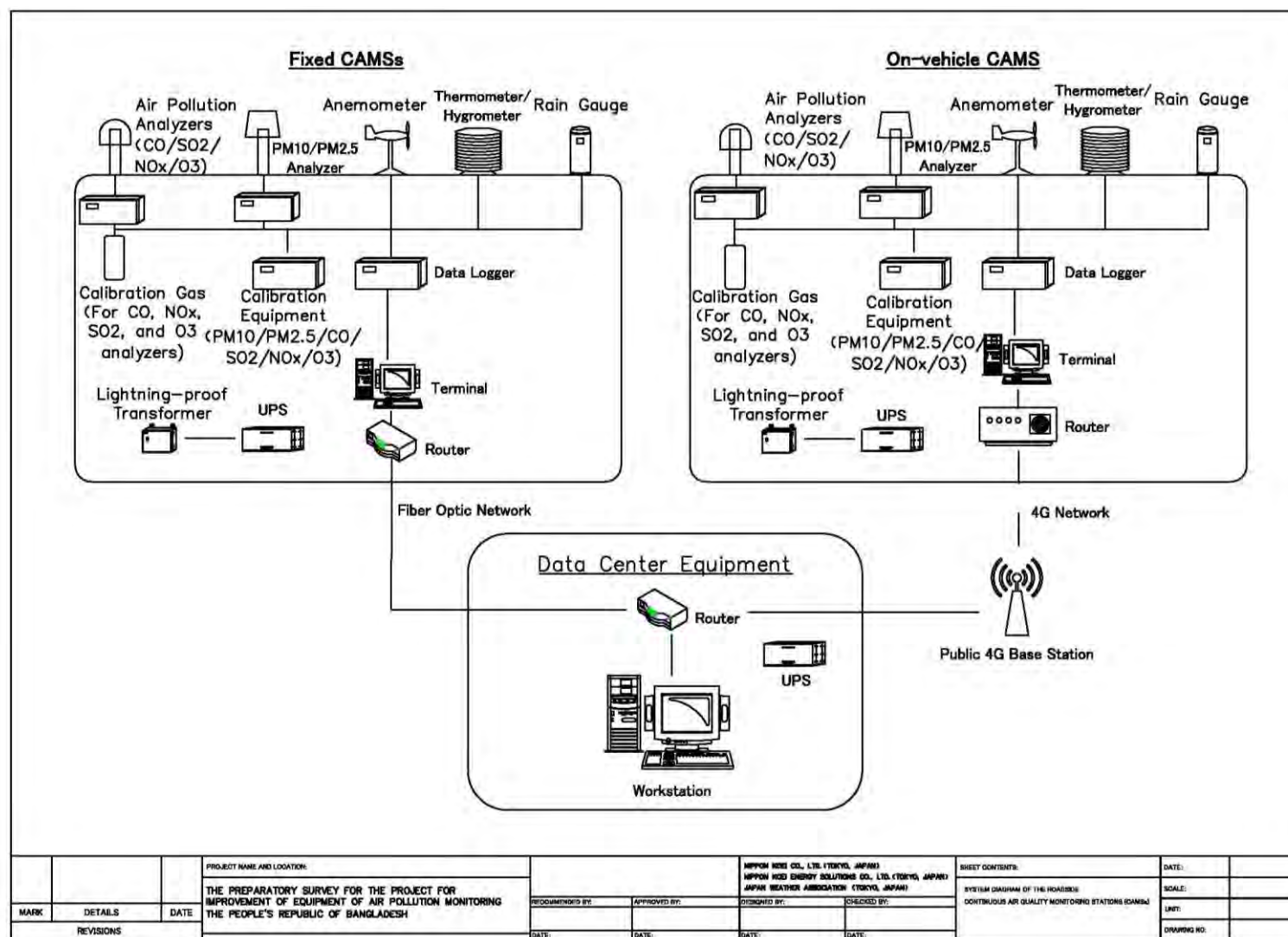
2-2-2-2-1 Overall Equipment Configuration

The functions of the overall system to be provided by this project are as follows:

- ✓ The target items are measured at the fixed CAMSs and the on-vehicle CAMS, while the measurement data is aggregated and monitored at the Data Center Equipment at the DoE Headquarters.

The equipment configuration to realize the above functions will be designed as the fixed CAMSs, on-vehicle CAMS, and the Data Center Equipment (located at the data center of the DoE Headquarters).

The overall system configuration diagram is shown in the figure below.



Source: JICA Survey Team

Figure 2-5 Overall System Configuration of the Project

2-2-2-2 Roadside CAMSs

The Roadside CAMSs shall be configured as shown in Table 2-3 to realize the functions of each equipment.

Table 2-3 Equipment Configuration and Functional Overview of the Roadside CAMSs

No.	Equipment	Functional Overview
1	Air Pollution Measurement Instruments	✓ Automatic measurement of seven items: NO ₂ , SO ₂ , PM _{2.5} , PM ₁₀ , O ₃ , CO, NO
2	Calibration Equipment for Air Pollution Measurement Instruments	✓ Adjustment of each measuring instrument to allow continuous accurate measurements
3	Meteorological Observation Instruments	✓ Automatic measurement of wind speed, temperature, humidity, and rainfall (It is used to determine the dispersion of hazardous substances emitted into the atmosphere.)
4	Communication and Power Supply Instruments	✓ Data transmission of measurement data for measuring stations and status data for measuring equipment (Wired communication lines are used for fixed CAMSs and mobile communication lines are used for on-vehicle CAMS.) ✓ Power supply shall be commercial power, and power supply facilities are arranged to enable a stable and continuous power supply to the measuring instruments.
5	Containers	✓ Housing measurement equipment, calibration equipment, meteorological measurement equipment, and communications and power supply equipment ✓ Buildings shall be container-type. ✓ Both fixed and on-vehicle CAMSs shall be of the same type, and one vehicle shall be added for on-vehicle CAMS.
6	Equipment for the Fixed and On-vehicle CAMS	✓ Air conditioning, fire extinguishers, and low-volume air samplers to operate each piece of equipment in the Roadside CAMSs.

Source: JICA Survey Team

(1) Air Pollution Measurement Equipment

The air quality measurement instruments to be provided for this project are designed to measure seven air pollutants, six for which, environmental standards for air quality have been established in the country, namely: NO₂, SO₂, PM_{2.5}, PM₁₀, O₃, and CO, plus NO, which are particularly affected by automobiles. In addition, the measurement equipment used for meteorological observation has five elements: wind direction and speed, temperature, humidity, and precipitation.

The selected measurement items for air quality are the same as the existing CAMSs and C-CAMSs. For meteorological items, the items are those commonly measured in existing CAMSs and C-CAMSs (wind direction and speed, temperature, humidity, precipitation, and solar radiation), except solar radiation, which could be substituted with measurement data from other CAMS and the Bangladesh Meteorological Department (BMD).

Regarding the selection of each measurement item for air quality and meteorology, the JICA Survey Team proposed to the DoE during the first field survey conducted from July to August 2023 and obtained the DoE's agreement. In addition, these air pollutant measurement devices are key components of this system, and continuous measurement is required. Therefore, a set of spare units is planned to be installed for every measurement item as a backup in case of unexpected failure of these units. The main specifications of each air pollutant measuring equipment are shown in Table 2-4. The equipment is needed to calibrate these measurement facilities. The main specifications of the

calibration equipment are shown in Table 2-5, and the main specifications of the meteorological instruments are shown in Table 2-6.

Table 2-4 Main Specifications of Air Pollution Measurement Equipment

Item	Main Specifications
Sulfur dioxide	(1) Measurement principle: UV fluorescence method (2) Measurement range: 0-0.05(required), 0-0.5 ppm or 0-1.0 ppm (3) Repeatability (reproducibility): $\pm 2\%$ of maximum scale value (at 0-0.05 ppm range) (4) Zero drift: ± 2ppb/day and ± 4ppb/week (at range 0 to 0.05 ppm) (5) Span drift: $\pm 2\%$/day and $\pm 4\%$/week of maximum scale value (at range 0 to 0.05 ppm) (6) Linearity (indication error): $\pm 4\%$ of maximum graduation value (in the range 0 to 0.05 ppm) (7) Stability of indicated value against power supply voltage fluctuation: Fluctuation of indicated value is $\pm 1\%$ of maximum graduation value (at range 0 to 0.05 ppm) against $\pm 10\%$ of rated voltage fluctuation. (8) Stability against ambient temperature variation: Satisfy the drift items (4) and (5) for a change of 5 °C within the temperature range of 0 to 40 °C. (9) Response time: 4 minutes or less (time from the entrance of the device to 90% of the final indicated value) (10) Minimum detection limit: 1 ppb or less (twice the standard deviation of the noise) (11) Number of display digits: 3 or more decimal places (1 ppb or less) when displayed in ppm (12) Effect of interfering components (toluene): 4 ppb or less on the indicated value even in the presence of 0.1 ppm toluene
Nitrogen oxides	(1) Measurement principle: chemiluminescence method (2) Measurement range: 0-0.1(required), 0-2.0 ppm or 0-20.0 ppm (3) Repeatability (reproducibility): $\pm 2\%$ of maximum scale value (at 0 to 0.1 ppm range) (4) Zero drift: ± 2 ppb/day and ± 4ppb/week (at range 0 to 0.1ppm) (5) Span drift: $\pm 2\%$/day and $\pm 4\%$/week of maximum scale value (at range 0 to 0.1 ppm) (6) Linearity (indication error): $\pm 4\%$ of maximum graduation value (in the range 0 to 0.1 ppm) (7) Stability of indicated value against power supply voltage fluctuation: Fluctuation of indicated value is $\pm 1\%$ of maximum graduation value (at range 0 to 0.1ppm) against $\pm 10\%$ of rated voltage fluctuation. (8) Stability of indicated value against changes in ambient temperature: Within the temperature range of 0 to 40 °C, the drift items (4) and (5) shall be satisfied for a change of 5 °C. (9) Converter efficiency: 95% or more (10) Response time: 3 minutes or less (time from the entrance of the device to 90% of the final indicated value) (11) Minimum detection sensitivity: 1 ppb or less (twice the standard deviation of noise) (12) Number of display digits: 3 or more decimal places when displayed in ppm (1 ppb or less) (13) Interference influence: Even in the presence of moisture (25 °C, 80% relative humidity), the influence on span shall be 4% or less of NO value, and even in the presence of NH 31 ppm, the influence on indicated value shall be 4 ppb or less.
PM ₁₀	(1) Measurement principle: Light scattering method or beta-ray absorption method (2) Relationship between physical quantity and mass: The physical quantity to be measured must have a constant relationship with mass or the correction relationship between the physical quantity to be measured and mass must be clear. (3) Characteristics of granulation device: For models with a granulation device, as in the filter collection-mass method, the characteristics of the granulation device shall be as follows: 50% particle size shall be 10.0 μm. (4) Averaging time (time resolution): The averaging time for automatic measurement instruments shall be 24 hours. The automatic measurement equipment shall be capable of outputting (recording) one-hour values. (5) Measurement concentration range: The measurement equipment shall be capable of measurement 1000 $\mu\text{g}/\text{m}^3$ as a daily average value and 1500 $\mu\text{g}/\text{m}^3$ as an hourly average value. (6) Instrument error: The difference between the daily average values of multiple units of the same model of automatic measurement equipment measured simultaneously (parallel measurement) must be within a certain range.
PM _{2.5}	(1) Measurement principle: Light scattering method or beta-ray absorption method (2) Relationship between physical quantity and mass: The physical quantity to be measured must have a constant relationship with mass, or the correction relationship between the physical quantity to be measured and mass must be clear. (3) Characteristics of granulation device: For models with a granulation device, as in the filter collection-mass method, the characteristics of the granulation device must be such that the 50% particle size is 2.5 μm. (4) Averaging time (time resolution): The averaging time for automatic measurement instruments shall be 24 hours. The automatic measurement equipment shall be capable of outputting (recording) one-hour values.

Item	Main Specifications
	(5) Measurement concentration range: The measurement equipment shall be capable of measuring 500 $\mu\text{g}/\text{m}^3$ as a daily average value and 1000 $\mu\text{g}/\text{m}^3$ as an hourly value. (6) Instrument error: The difference between the daily average values of multiple units of the same model of automatic measurement equipment measured simultaneously (parallel measurement) must be within a certain range.
Ozone	(1) Measurement principle: UV absorption method (2) Measurement range: 0 to 0.1ppm (required), 0 to 1.0 ppm or 0 to 10.0 ppm (3) Repeatability: $\pm 2\%$ of maximum scale value (at 0 to 0.1 ppm range) (4) Zero drift: ± 2 ppb/day and ± 4 ppb/week (at 0 to 0.1 ppm range) (5) Span drift: $\pm 2\%$/day and $\pm 4\%$/week of maximum scale value (at 0 to 0.1 ppm range) (6) Linearity (indication error): $\pm 4\%$ of maximum graduation value (at 0 to 0.1 ppm range) (7) Stability of indicated value against power supply voltage fluctuation: $\pm 1\%$ of maximum graduation value/$\pm 10\%$ of rated voltage (at 0 to 0.1 ppm range) (8) Stability of indicated value against changes in ambient temperature: Must satisfy the drift clause of (4) and (5) for a change of 5 °C within the temperature range of 0 to 40 °C. (9) Efficiency of ozone decomposer: 99.5% or more (10) Response time: 2 minutes or less (time from the entrance of the device to 90% of the final indicated value) (11) Minimum detection limit: 1 ppb or less (twice the standard deviation of the noise) (12) Stability over time of sample atmospheric flow rate: $\pm 5\%$ or less for 3 or more tests in 10 days (13) Number of display digits: At least 3 decimal places (1 ppb or less) when displayed in ppm (14) Interference influence (water): Influence on the indicated value shall be 4 ppb or less even in the presence of moisture (25°C, 80% relative humidity). (15) Interference influence (toluene): Even in the presence of 1 ppm toluene, the influence on the indicated value shall be 4 ppb or less.
Carbon monoxide	(1) Measurement principle: Infrared absorption method or non-dispersive infrared absorption method (2) Measurement range: 0~5ppm (required), 0~100 ppm or 0~300 ppm (3) Repeatability: $\pm 2\%$ of maximum scale value (at 0 to 5 ppm range) (4) Zero drift: $\pm 2\%$ of maximum graduation value/day (at 0 to 5 ppm range) (5) Span drift: $\pm 2\%$/day of maximum graduation value (at 0 to 5 ppm range) (6) Linearity (indication error): $\pm 4\%$ of maximum graduation value (at 0 to 5 ppm range) (7) Stability of indicated value against power supply voltage fluctuation: Fluctuation of indicated value is $\pm 1\%$ of maximum graduation value (at 0 to 5 ppm range) against $\pm 10\%$ of rated voltage fluctuation. (8) Response time: 2 minutes 30 seconds or less (time from the entrance of the device to 90% of the final indicated value) (9) Minimum detection limit: $\pm 1\%$ or less of the maximum scale value (at 0 to 5 ppm range) (10) Interference influence: $\pm 5\%$ of maximum graduation value, or 0.3 ppm or less at 0 to 5ppm range

Source: Prepared by the JICA Survey Team referring to the Japanese Manual for Continuous Monitoring of Air Quality (6th edition)

Table 2-5 Main Specifications of Calibration Devices for Air Pollution Measurement Equipment

Item	Main Specifications
Sulfur dioxide	1. Sulfur dioxide standard gas (1) Concentration range: 0 to 50 ppm (2) Dilution gas: Nitrogen or zero gas purifier (3) Accuracy (%): The accuracy of the standard gas is equivalent to that of a second-class standard gas based on the traceability system of the Measurement Act (JCSS). (4) Quantity of gas (%): The standard gas is assumed to be valid for one year, and the frequency of calibration is assumed to be at least automatic calibration (once a week), daily inspection (twice a month), periodic inspection (once a year), and emergency inspection (five times a year). 2. Standard gas generator (1) Zero gas purity (purification capability): Concentration of component gases to be measured: 1 ppb or less (2) Span gas adjustment concentration Repeatability: Within $\pm 2.0\%$ of the adjusted concentration Overall accuracy: within $\pm 4.0\%$ of adjusted concentration 3. Pressure regulator (if necessary) Equipment to reduce the pressure of the standard gas compressed at high pressure in a cylinder to the allowable pressure of the measurement instrument (including a high-pressure side pressure gauge, low-pressure side pressure gauge, safety valve, and flow meter). 4. Automatic calibration equipment Equipment required for automatic calibration of the measurement instrument (may be included in the measurement instrument).

Item	Main Specifications
Nitrogen oxides	1. Nitrogen oxide standard gas (1) Concentration range: 0 to 100 ppm (2) Dilution gas: Nitrogen or dilution by zero gas purifier (3) Accuracy: The accuracy of the standard gas is equivalent to that of a second-class standard gas based on the traceability system of the Measurement Act (JCSS). (4) Gas quantity: The standard gas is assumed to be valid for one year, and the calibration frequency is assumed to be at least automatic calibration (once a week), daily inspection (twice a month), periodic inspection (once a year), and emergency inspection (five times a year). 2. Standard gas generator (1) Zero gas purity (purification capability): Concentration of component gases to be measured: 1 ppb or less (2) Span gas adjustment concentration - Repeatability: Within $\pm 2.0\%$ of the adjusted concentration - Overall accuracy: within $\pm 4.0\%$ of adjusted concentration 3. Pressure regulator (if necessary) - Equipment to reduce the pressure of the standard gas compressed at high pressure in a cylinder to the allowable pressure of the measurement instrument (including a high-pressure side pressure gauge, low-pressure side pressure gauge, safety valve, and flow meter). 4. Automatic calibration equipment - Equipment required for automatic calibration of the measurement instrument (may be included in the measurement instrument).
PM ₁₀	Equipment for Calibration of Automatic PM₁₀ (1) Beta-ray absorption method - Equivalent membrane used as equivalent input for static calibration (estimate may be included in the main unit of the measurement instrument) (2) Light scattering method - Standard scattering plate used as equivalent input for static calibration (estimate may be included in the main body of the measurement instrument) - Standard particles used for dynamic calibration: Average particle size 0.3 μm, geometric standard deviation $\sigma_g = 1.5\%$ or less. For models using a semiconductor laser, polystyrene latex particles with a particle diameter of 0.6 μm.
PM _{2.5}	Equipment for Calibration of PM_{2.5} (1) β-ray absorption method - Equivalent membrane used as equivalent input for static calibration (estimate may be included in the main body of the measurement instrument) (2) Light scattering method - Standard scattering plate used as equivalent input for static calibration (estimate may be included in the main body of the measurement instrument)
Ozone	1. Standard gas for ozone calibration (zero gas) (1) Zero gas: Environmental zero adjustment standard gas (synthetic air or purified air) packed in a high-pressure container. (2) Quantity of gas: Zero gas is assumed to be valid for one year, and the frequency of calibration is assumed to be at least automatic calibration (once a week), daily inspection (twice a month), periodic inspection (once a year), and emergency inspection (five times a year). 2. Pressure regulator (if necessary) - Equipment to reduce the pressure of standard gas compressed at high pressure in a cylinder to the allowable pressure of the measurement instrument (including a high-pressure side pressure gauge, low-pressure side pressure gauge, safety valve, and flow meter).
Carbon monoxide	1. Carbon monoxide standard gas (1) Concentration range: 0 ppm to 100 ppm (2) Dilution gas: Nitrogen or zero gas purifier (3) Accuracy (%): Equivalent to Class 2 standard gas based on the traceability system of the Measurement Act (JCSS). (4) Gas quantity: The standard gas is assumed to be valid for one year, and the frequency of calibration is assumed to be at least automatic calibration (once a week), daily inspection (twice a month), periodic inspection (once a year), and emergency inspection (five times a year). 2. Pressure regulator (if necessary) - Equipment to reduce the pressure of standard gas compressed at high pressure in a cylinder to the allowable pressure of the measurement instrument (including a high-pressure side pressure gauge, low-pressure side pressure gauge, safety valve, and flow meter). 3. Automatic calibration equipment - Equipment required for automatic calibration of the measurement instrument (may be included in the measurement instrument).

Source: Prepared by the JICA Survey Team referring to the Japanese Manual for Continuous Monitoring of Air Quality (6th Edition)

Table 2-6 Main Specifications of Meteorological Instruments

Meteorological Observation Items	Main Specifications
Wind Speed and Direction	(1) Measurement principle: Anemometer or ultrasonic anemometer (2) Measurement range: Wind direction: 0 to 360° (359.9° also possible) in all directions, wind speed: 0.4 to 20 m/s (3) Measurement accuracy: wind direction: within ± 3 (4) Starting wind speed: 0.4 m/s or less (5) Wind resistance: 60 m/s or more
Temperature	(1) Measurement principle: Platinum resistance thermometer or NTC thermistor (2) Measurement range: -20 to 40 °C inclusive (3) Measurement accuracy: within ± 0.5 °C
Humidity	(1) Measurement principle: Capacitive hygrometer or solid-state sensor (2) Measurement range: 0 to 100% (3) Measurement accuracy: within ± 5
Precipitation	(1) Measurement principle: Tipping type or sensor type (2) Measurement range: 0 to 0.5 mm (tipping type), 0.3 to 5 mm/h (sensor type) (3) Measurement accuracy: Less than $\pm 5\%$ (tipping type), 0.01mm/h (sensor type)

Source: Prepared by the JICA Survey Team with reference to the Japanese Manual for Continuous Monitoring of Air Quality (6th Edition)

(2) Building for the Roadside CAMS

The Roadside CAMS consists of air quality measurement equipment and a building for storing them. There are two types of buildings, i.e.: one is constructed of reinforced concrete or blocks, and the other is a container-type building.

The construction cost of a reinforced concrete building is expected to be lower than that of container-type, but the concern for the concrete building is about water leakage due to rain. On the other hand, the cost of the container-type building is expected to be higher, but its watertightness and airtightness against rainwater can be ensured, providing a safer and more secure building. In addition, in the case of the container-type, the measurement location can easily be changed because it is easier to move it than a reinforced concrete building. Based on the above comparison, the container-type building will be adopted for more stable and continuous measurement.

The container-type building shall be insulated and waterproofed to ensure stable operation of the measurement equipment and to maintain measurement accuracy. It shall be durable enough to be used for at least 20 years through appropriate maintenance and management. Two air conditioners shall be installed, one of which shall be treated as a spare. However, the spare should be operated moderately to extend its expected service life, and it should be planned to be operated alternately with a cycle of about one month span.

The container-type building should be constructed on a foundation built on the ground. The foundation should be 0.5 m deep below ground level and 1.0 m above ground level, and the container station building should be raised 1.0 m above the ground surface. Security facilities (e.g., fences, block walls, etc.) should be installed around the container station building.

(3) Communication and Power Supply Equipment

The existing system owned by DoE used a mobile communication line employing a cellular network when it was first installed, but due to many missing data caused by communication breakdowns, the system was converted to a wired communication line using an IP network. Therefore, in the project as well, the communication system will use wired communication lines provided by telecommunication carriers in Bangladesh. On the other hand, since on-vehicle CAMS are moving, mobile communication lines using cellular networks will be used for on-vehicle CAMS.

In addition, to provide a continuous measurement environment, uninterruptible power supply (UPS) equipment is planned to be installed at each Roadside CAMS in case of power failure. UPS will be installed as a countermeasure against power failure. The power backup target shall be the measurement equipment and data storage equipment. The backup time shall be 120 minutes. Considering the unstable power supply situation in the country, a UPS with a constant inverter power supply system will be adopted to stabilize the power supply.

The communication lines and power supply lines to each of the Roadside CAMS are planned to be provided at the expense of the counterpart country. The project will cover communication equipment such as routers and power supply equipment such as lightning transformers to be installed in the Roadside CAMSs.

2-2-2-2-3 Data Center Equipment

The Data Center Equipment is planned to have the following functions:

- ✓ Automatic aggregation of measurement data for each measuring station
- ✓ Automatic display of aggregated measurement data (including alarm display)
- ✓ Correction of aggregated measurement data by operator
- ✓ Status display of measurement stations (e.g., equipment failure)
- ✓ Data capture by external memory
- ✓ Report creation
- ✓ Transmission of data to existing systems

The data from the existing measurement stations are consolidated at the DoE Headquarters Data Center, and the Data Center Equipment will also be installed at the same center. Since the existing centralized equipment uses a workstation (desktop type), the Data Center Equipment shall also be configured with a workstation (desktop type) and necessary software shall be installed, considering the maintenance and operation by the DoE staff.

In order to avoid interface compatibility issues, the Roadside CAMSs to be installed under the project will not be directly connected to the existing centralized equipment. For this reason, data center equipment for the Roadside CAMSs will be installed as the centralized equipment for the project. The system configuration installed by the project will be independent of the existing CAMS system, so that system failures in either system will not affect the other.

However, in order to achieve the data integration requested by DoE, the workstations to be installed in the project shall be equipped with a function to transmit measurement data to the database of the existing system. Since the database of the existing system uses Oracle and includes functions that allow the input of external data, the data collected in the project will be imported into the existing system by utilizing these functions.

2-2-2-2-4 List of Equipment to be Procured

Table 2-7 shows the list of equipment to be procured for the Roadside CAMSs and Table 2-8 shows the list for the Data Center Equipment.

Table 2-7 List of Equipment to be Procured for the Roadside CAMSs

No	Equipment	Main Specifications	Quantity
Air pollution measurement			
1	Automatic PM _{2.5} , PM ₁₀ Analyzer	To measure PM _{2.5} and PM ₁₀ concentrations by light scattering method or beta-ray absorption method	8
2	Automatic CO Analyzer	To measure CO concentration by infrared absorption method or non-dispersive infrared absorption method	8
3	Automatic SO ₂ Analyzer	To measure SO ₂ concentration by UV fluorescence method	8
4	Automatic NO, NO ₂ Analyzer	To measure NO, NO ₂ , NO _x concentrations by chemiluminescence method	8
5	Automatic O ₃ Analyzer	To measure O ₃ concentration UV absorption method	8
Calibration			
6	Calibration Gas, Pressure Regulator (CO, SO ₂ , NO _x)	The gas cylinder shall be filled with the gas to be used for calibration	2
7	Standard Gas Generator	To adjust the concentration of the gas in the calibration gas cylinder and supply it to the measurement instruments	8

No	Equipment	Main Specifications	Quantity
Data acquisition			
8	Data Logger, Terminal, Software	To collect, store, display, modify and transmit measurement data to the Data Center Equipment	8
Containers			
9	Container for the Fixed CAMS	Less than 2500Wx2500Hx4000L (mm) Less than 4 tons	7
10	Container for the On-Vehicle CAMS	Less than 2500Wx2500Hx4000L (mm) Less than 4 tons	1
11	Container Hanging Fixture	Container lifting jig, balance bar, lifting belt set	2
12	Vehicle for the On-Vehicle CAMS	Truck chassis of 2 tons long class	1
Meteorological observation			
13	Meteorological Observation Instruments	To measure each meteorological observation items	8
Telecommunication and power			
14	Router for the Fixed CAMS	LAN and WAN interfaces VPN function Firewall function	7
15	Router for the On-Vehicle CAMS	4G/LTE communication function LAN interfaces VPN function Firewall function	1
16	UPS for the Fixed and On-Vehicle CAMS	Output: 3kVA Backup time: 120min Power supply method: Continuous inverter power supply method	8
17	Lightning-proof Transformer	Capacity: 7.5kVA Inrush current limiting function Withstand voltage: 10kV AC (one minute), impulse 30kV (1.2/50μs)	8
Auxiliary equipment			
18	Air Conditioner	Rated output: 2.2kW Rated power consumption: 635W	16
19	Fire Extinguisher	For ordinary combustibles, oil and electrical fire	8
20	Low-Volume Air Sampler	Rated flow rate: 5L/min External power supply and lithium-ion battery compatible Portable	8

Source: JICA Survey Team

Table 2-8 List of Equipment to be Procured for the Data Center Equipment

No	Equipment	Main Specifications	Quantity
1	Workstation, Software, Monitoring Terminal	To collect, store, display, and modify measurement data from each measuring station, as well as transmit the data to an existing database	1
2	Router for the Data Center Equipment	LAN and WAN interfaces VPN function Firewall function	1
3	UPS for the Data Center Equipment	Output: 3kVA Backup time: 120min Power supply method: Continuous inverter power supply method	1

Source: JICA Survey Team

2-2-2-2-5 Other (Consumables and Replacement Parts, Spare Equipment)

As the project implementation will require consumables and replacement parts for the maintenance of the newly installed equipment, DoE will need to prepare a budget for such items.

The project will support consumables and replacement parts for the next three years, taking into account the time lag until the approval of budget that includes the consumables and replacement parts required after the installation of the measurement equipment under the project.

For some consumables, equipment with an expiration date of one year or less will be considered as necessary equipment within the defect period of the equipment to be installed under the project, and additional consumables and replacement parts will be provided to reduce the financial burden on DoE as much as possible. The calibration gas procured in Japan has a shelf life of less than one year. Therefore, one set is transported from Japan at the same time as the other equipment, and the other set is transported from Japan before the manufacturer's warranty expires. Thereafter, the DoE procures it. Table 2-9 shows the list of equipment to be procured for the consumables and replacement parts while Table 2-10 shows the list for the spare equipment.

Table 2-9 List of Equipment to be Procured for the Consumables and Replacement Parts

No	Equipment	Main Specifications	Quantity
1	Three-year Periodic Replacement Parts for the PM _{2.5} , PM ₁₀ Analyzer	Periodic replacement parts for the automatic PM _{2.5} , PM ₁₀ analyzer	8
2	Three-year Periodic Replacement Parts for the CO Analyzer	Periodic replacement parts for the automatic CO analyzer	8
3	Three-year Periodic Replacement Parts for the SO ₂ Analyzer	Periodic replacement parts for the automatic SO ₂ analyzer	8
4	Three-year Periodic Replacement Parts for the NO, NO ₂ Analyzer	Periodic replacement parts for the automatic NO, NO ₂ analyzer	8
5	Three-year Periodic Replacement Parts for the O ₃ Analyzer	Periodic replacement parts for the automatic O ₃ analyzer	8
6	Replacement Parts for the Standard Gas Generator and Pressure Regulator	Filters, O-rings, pumps, diaphragms, solenoid valves, xenon lamps, UV lamps, LED units, etc.	1

Source: JICA Survey Team

Table 2-10 List of Equipment to be Procured for Spare Equipment

No	Equipment	Main Specifications	Quantity
1	Automatic PM _{2.5} , PM ₁₀ Analyzer	Spare of automatic PM _{2.5} , PM ₁₀ analyzer	1
2	Automatic CO Analyzer	Spare of automatic CO analyzer	1
3	Automatic SO ₂ Analyzer	Spare of automatic SO ₂ analyzer	1
4	Automatic NO, NO ₂ Analyzer	Spare of automatic NO, NO ₂ analyzer	1
5	Automatic O ₃ Analyzer	Spare of automatic O ₃ analyzer	1
6	Standard Gas Generator	Spare of standard gas generator	1
7	Meteorological Observation Instruments	Spare of meteorological observation instruments	1

Source: JICA Survey Team

2-2-3 Outline Design Drawing

A diagram of the overall configuration of the system to be installed in the project is shown in Figure 2-5. The location of Roadside CAMSs at each site is described in Appendix 6.

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

In the project, the fixed CAMSs will be installed at seven sites in Dhaka City and Chattogram City, and the on-vehicle CAMS and the Data Center Equipment will be installed in the DoE Office. The implementation process will include foundation work, equipment installation work for the fixed

CAMSs, equipment installation work for the on-vehicle CAMS, and the installation work for the Data Center Equipment. After the installation works, adjustment and trial operation, initial technical guidance, and operational guidance will be implemented.

2-2-4-2 Implementation Conditions

In the project, the containers procured in Japan will be installed after the foundation of the fixed CAMS containers is constructed. Since it is difficult to secure a site for temporary storage of the containers by DoE, the containers will be transported to their respective sites soon after they arrive at the Chattogram Port and customs clearance. Therefore, it is necessary to complete the foundation work before the containers arrive at the site.

2-2-4-3 Scope of Works

The procurement of the equipment listed in Table 2-7 and Table 2-8, construction of the foundation, installation, and adjustment of the equipment, and inspection work, as well as consulting services for designing and managing these tasks, will be carried out by the Japanese side. The work to be carried out by the Bangladesh side will include the acquisition of the lands for the fixed CAMSs and preparations for the implementation of the project. The details of the implementation items to be carried out by the Bangladesh side are described in 2-4.

Table 2-11 Items to be Implemented by the Japanese Side and Bangladesh Side

Japanese Side	Bangladesh Side
• Procurement of equipment • Installation work (foundation work, installation work of the fixed CAMS containers) • Installation and adjustment of the equipment • Initial operation instruction • Consulting services	• Conclusion of a basic agreement for using secured lands for the fixed CAMSs • Preparation for project implementation - Obtaining the necessary permits and approvals for the fixed CAMSs - Securing communication lines and power supply for the fixed and on-vehicle CAMSs • Smooth project implementation - Customs clearance of equipment, support for domestic transportation - VAT and AIT processing, budgeting, payments

Source: JICA Survey Team

2-2-4-4 Consultant Supervision

2-2-4-4-1 Design and Bidding Works

A consultancy contract will be signed between DoE and the Japanese consultant. The consultant services contract will include the following contents, and the personnel plan is shown in Table 2-12.

Table 2-12 Personnel Plan for Design Works

Position	Job Details
Chief Consultant	Overall management of final confirmation of project contents, review of equipment specifications, and bidding-related work
Equipment Engineer 1 (Environmental Equipment)	Final confirmation of project contents, review of equipment specifications, and bidding-related work for the air pollution measurement instruments
Equipment Engineer 2 (Communication and Power Supply Equipment)	Final confirmation of project contents, review of equipment specifications, and bidding-related work for the communication and power supply equipment
Equipment Engineer 3 (Foundation and CAMS containers)	Final confirmation of project contents, review of equipment specifications, and bidding-related work for the foundation and CAMS containers

Source: JICA Survey Team

(1) Confirmation of the Project Contents and Review of Specifications

Final confirmation of the project will be conducted in Bangladesh, and equipment specifications will be confirmed in Japan based on the results of the final confirmation.

In the final confirmation of the project, based on the results of the preparatory survey, the design details and detailed location of the fixed CAMSs will be confirmed through on-site surveys and discussions with the Bangladesh side. The progress and schedule of the items to be borne by the Bangladesh side will also be clarified.

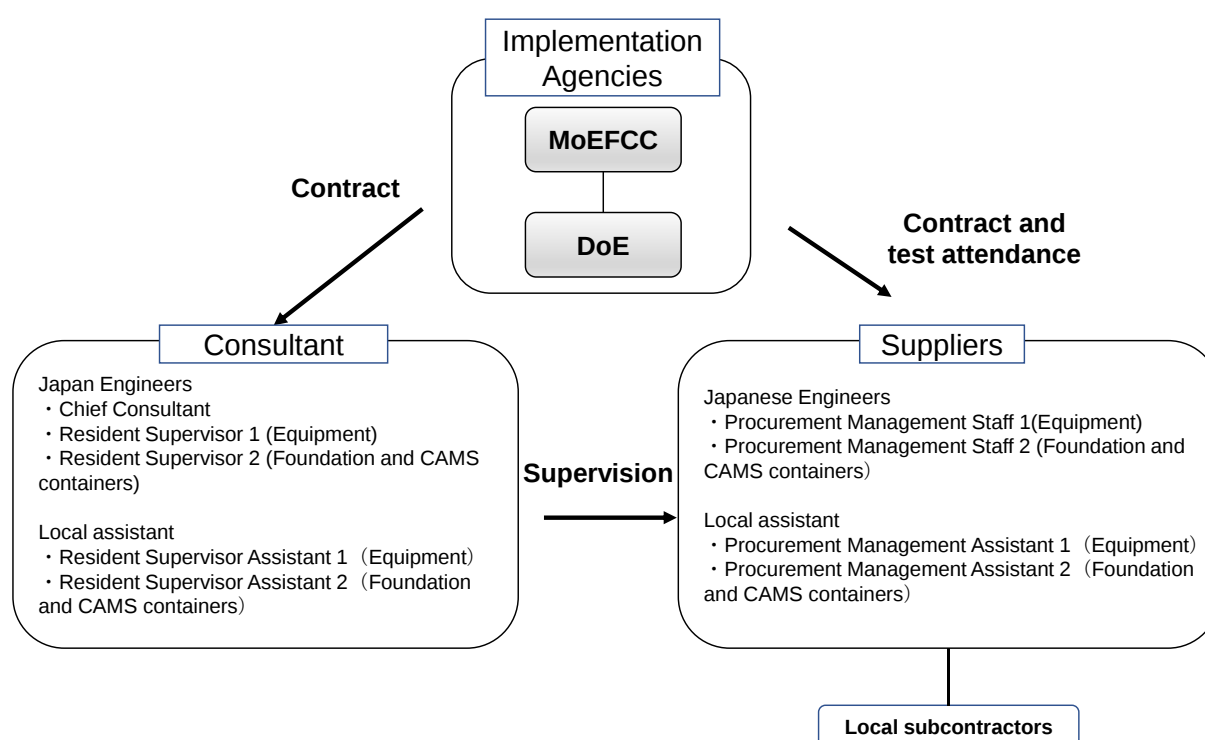
In the confirmation of equipment specifications, the specifications of the equipment and CAMS containers will be confirmed based on the results of the final confirmation of the project, and if necessary, these will be revised, and an estimate of construction costs and construction plan will be formulated. In the review, it is necessary to examine the specifications of the equipment and the functions of the Data Center Equipment. It is also necessary to assess the containers of the CAMSs and its foundation work considering the latest site situations.

(2) Assistance in Bidding Works

Bidding documents will be prepared in accordance with the detailed design, construction plan, and grant aid project. In addition, public announcement of bids and evaluation of bids will be carried out in cooperation with the implementing agencies.

2-2-4-4-2 Procurement and Installation Supervision Works

In the procurement and installation supervision, the procurement supervisor will cooperate with the implementing agency in pre-commencement discussions, approval of design drawings, pre-shipment product inspections, on-site installation supervision, preparation of work reports, inspections, and procedures, from the standpoint of the supervisor. Figure 2-6 shows the correlation diagram of related organizations in the procurement supervision for the project. The personnel plan is shown in Table 2-13.



Source: JICA Survey Team

Figure 2-6 Correlation Diagram of Related Organizations

Table 2-13 Personnel Plan for the Procurement Supervision Works

Position	Job Details
Chief Consultant	Overall project coordination, guidance, and supervision of the procurement supervisory personnel
Resident Supervisor 1 (Equipment)	✓ On-site presence throughout the equipment installation period to perform overall procurement supervision ✓ Quality, progress, payment procedures, consultation, and reporting with counterpart ✓ Progress of equipment procurement and installation, quality and safety supervision ✓ Attendance during inspections prior to the expiration of the defect liability period
Resident Supervisor 2 (Foundation and CAMS containers)	✓ On-site presence throughout the foundation construction period of the Roadside CAMSs and overall procurement supervision ✓ Quality, progress, payment procedures, consultation, and reporting with counterpart ✓ Procurement of materials, progress of installation work, quality and safety supervision
Inspection Engineer 1 (Equipment of air pollution measurement)	Checking and verifying drawings related to air pollutant measurement equipment
Inspection Engineer 2 (Equipment of ICT)	Checking and verifying drawings of communication facilities, power supply facilities, information terminals for central monitoring facilities (workstations, etc.), etc.
Inspection Engineer 3 (Foundation and CAMS containers)	Checking and verifying drawings related to the station and its foundation
Inspection Engineer 4 (Factory test)	Witness product factory inspections
Inspection Engineer 5 (Inspection of pre-shipment)	Witness pre-shipment inspections

Source: JICA Survey Team

2-2-4-5 Quality Control Plan

Quality control of materials, equipment, and installation work to be procured for the project will be carried out in the following manner.

2-2-4-5-1 Drawing Review

The contractor for the project shall be required to submit drawings for all materials equipment, and installation plans, and the consultant shall verify that their specifications and quality are consistent with the specifications.

2-2-4-5-2 Factory On-Site Inspection

After the contractor completes the manufacture of the equipment and purchase of materials, and when the overall operation of the system has been verified and the performance and quantities of the specifications have been satisfied, an on-site inspection shall be conducted at the factory to verify the quantities and performance of the system.

2-2-4-5-3 Pre-shipment Equipment Verification

When the factory on-site inspection is completed and the contractor has packed all materials and equipment and is ready to ship, a third-party inspection is conducted to inspect the packing quantity, packing style, shipping marks, etc., of the materials and equipment using a packing list.

2-2-4-5-4 Field Test

The results of on-site installation work are verified through installation inspections and field tests. The field tests are divided into individual tests to verify the function of each piece of equipment, and comprehensive tests to verify the overall system function. The contractor takes the lead in conducting the field tests, which are witnessed by the consultant and the implementing agency. After the field test is conducted, an inspection completion report is submitted to JICA and the Government of Bangladesh to certify completion.

2-2-4-5-5 Manufacturer's Warranty

The contractor shall guarantee the quality of the materials and equipment for one year after the completion and delivery inspection is completed, and shall work to restore any defects caused by initial defects in the equipment, etc. without delay.

2-2-4-6 Procurement Plan

The air pollutant measurement equipment is not manufactured in Bangladesh, and there are two Japanese suppliers that manufacture the air pollutant measurement equipment and have overseas operations. In the project, the complete set of equipment for the air pollutant measurement system will be procured from Japan. The power supply and communication equipment will be procured in Bangladesh. Low-volume air samplers shall be procured in Bangladesh. Table 2-14 shows the procurement list of the equipment.

Table 2-14 Procurement List of Equipment

No	Equipment	Procurement country		
		Bangladesh	Third-country	Japan
1	Automatic PM _{2.5} , PM ₁₀ Analyzer	-	-	○
2	Automatic CO Analyzer	-	-	○
3	Automatic SO ₂ Analyzer	-	-	○
4	Automatic NO, NO ₂ Analyzer	-	-	○
5	Automatic O ₃ Analyzer	-	-	○
6	Calibration Gas, Pressure Regulator (CO, SO ₂ , NO _x)	-	-	○
7	Standard Gas Generator	-	-	○
8	Data Logger, Terminal, Software	-	-	○
9	Container for the Fixed CAMS	-	-	○
10	Container for the On-Vehicle CAMS	-	-	○
11	Container Hanging Fixture	-	-	○
12	Vehicle for the On-Vehicle CAMS	○	-	○
13	Workstation, Software, Monitoring Terminal	-	-	○
14	Meteorological Observation Instruments	-	-	○
15	Router for the Fixed CAMS	○	-	○
16	Router for the On-Vehicle CAMS	○	-	○
17	Router for the Data Center Equipment	○	-	○
18	UPS for the Fixed and On-Vehicle CAMS	○	-	○
19	UPS for the Data Center Equipment	○	-	○
20	Lightning-proof Transformer	○	-	○
21	Air Conditioner	○	-	○
22	Fire Extinguisher	○	-	○
23	Low-Volume Air Sampler	○	-	○

Source: JICA Survey Team

2-2-4-7 Initial Operation / Operation Planning Guidance

In order to ensure continuous operation of the installed equipment over a long period of time, the Japanese engineer (the contractor for the project) will provide operational guidance. The guidance will mainly target to the DoE staff but will also include contractors who are actually involved in operation and maintenance. The operational guidance is expected to be provided by a Japanese engineer for a period of about 20 days, which will also serve as on-the-job training.

The instruction will include initial operational guidance on the basic operation of the Data Center Equipment and the various equipment in the Roadside CAMSs. In addition, comprehensive operational guidance will be provided on the maintenance and management methods for the equipment of the system.

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

Since technical assistance is deemed necessary for the project, a soft component plan was developed. The plan is attached to this report. The objectives of the soft component are as follows:

- ✓ Long-term continuous air quality monitoring data can be obtained through the operation and maintenance of the Roadside CAMSs by the DoE officers.
- ✓ Environmental status can be assessed by the DoE officers using the data obtained from the Roadside CAMSs.

The outputs and contents of the training are shown in Table 2-15. A careful consideration on gender balance is required for DoE in selecting the trainees. The technical assistance will start after the installation of the Roadside CAMSs and end in one year. Output 1 will start shortly after take over from the contractor. Output 2 will be implemented on two occasions: one is just after the completion of the Output 1, and the other is at the end of the period when the various monitoring data have been accumulated including the dry and rainy seasons.

Table 2-15 Outputs and Contents of the Soft Component

Output	Contents	Trainee	Period (days)
Output 1: Development of the plan for preventive inspection and O&M	1. The necessary budget and implementation system are clarified by developing the budget/staffing plan of preventive inspection and O&M.	DoE AQMW Leader: 1 Assigned officer: 1	After take over Three days in Dhaka
	2. Preventive maintenance of the Roadside CAMSs is implemented and the results are reported and stored based on the developed procedure manual on preventive inspection and O&M.	DoE AQMW Leader: 1 Assigned officer: 2	Six days in Dhaka Five days in Chattogram
	3. Each equipment is adequately inspected using checklists, etc., using the developed procedure manual on equipment management. A system for accumulating the results of troubleshooting will be developed.	DoE Chattogram Lab Leader: 1 Assigned officer: 2	

Output	Contents	Trainee	Period (days)
Output 2: Enhancement of the capability on accuracy control and analysis of monitoring data.	1. Abnormal values of monitoring results of air quality and meteorology obtained by the Roadside CAMSs are identified and eliminated based on the developed procedure manual on data screening. 2. Analysis of time series data and relationships between measurement items and determination of the status of compliance with environmental standards will be conducted based on the manual on data processing.	DoE AQMW Leader: 1 Assigned officer: 2	1 st training: Data acquisition Immediately after the completion of the Output 1 Two days in Dhaka (Before the training, a Japanese expert will visit Dhaka and Chattogram to check the situation for three days) 2 nd training: Data processing When the data from the dry and rainy seasons accumulated 11 days in Dhaka

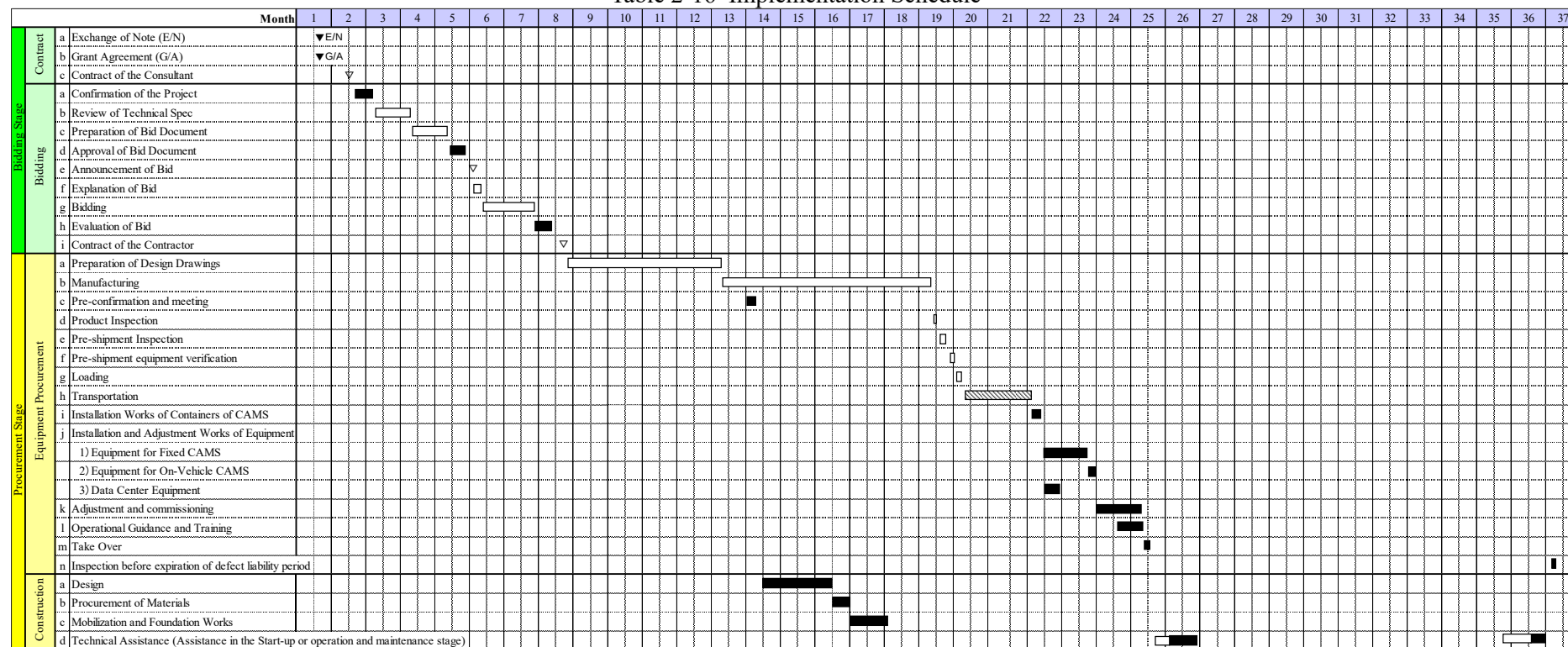
Note: Participants are not precluded from attending more than the number indicated. The number of training days does not include holidays.

Source: JICA Survey Team

2-2-4-9 Implementation Schedule

The implementation schedule is shown in Table 2-16.

Table 2-16 Implementation Schedule



Source: JICA Survey Team

2-3 Security Plan

Since the project is not a large-scale and long-term work, safety risks are low and no special safety measures need to be taken; however, it is necessary to pay attention to the situation in Bangladesh and to read carefully JICA's "Bangladesh Country Safety Manual" and act in accordance with the manual.

2-4 Obligations of Recipient Country

In the project, the following tasks shall be shared by the Bangladesh side.

2-4-1 Acquisition of Land

No land acquisition will be carried out for this project. The land use approval for the seven fixed stations (five in Dhaka and two in Chattogram) has been obtained as of October 21, 2024.

In order to ensure that the land can be used for this project, DoE will proceed with the conclusion of basic agreements with each landowning agency shown in Table 2-2. These basic agreements will specify the period of use of the land and the period of advance notice required when requesting removal, etc., and in general, they will not be legally binding. The time required to finalize these agreements will depend on the status of discussions between DoE and each landowning agency, but it would be desirable to finalize them at the earliest opportunity.

2-4-2 Preparation for Project Implementation

For the permits required to construct fixed CAMSs, it is necessary to submit a letter from DoE to RAJUK or CDA for the installation of fixed CAMS (container-type), and if trees need to be cut down¹, it is necessary to obtain the necessary permits from the Forest Department of Bangladesh by DoE. In addition, it is necessary to carry out land leveling, etc. at the site where fixed CAMS is to be constructed as necessary. It is desirable to submit the letter and to obtain permission before the tender notice.

In addition, it is necessary to have a contract with local telecommunication carriers for mobile communication service for the on-vehicle equipment and fixed-line (optical fiber) communication service for the fixed CAMSs, including the connection work to the measurement station. Similarly, it is necessary to include power distribution facilities and distribution lines as power sources for the Roadside CAMSs, and to supply commercial power lines to the Roadside CAMSs. It is desirable to proceed with the contract so that local telecommunication carriers and power distribution companies can begin connection work promptly after fixed CAMSs are installed.

It is also necessary to secure a warehouse to store replacement parts (including consumables) for the equipment provided by the project. In the storage of these replacement parts (including consumables), it is desirable to keep the temperature in the range of -5 °C to 45 °C in an air-conditioned room. The size of the replacement parts (including consumables) is expected to be approximately 5 m³ in total. DoE agreed to prepare a space with air conditioning for the replacement parts, including consumables, by DoE.

Development Project Proposal (DPP), which is required to implement the project in Bangladesh, must be approved by the government of Bangladesh. In addition, since DPP will include the budget and technical details of the project, it is necessary to support DoE in the survey and to proceed with the project on the DoE's own initiative. DPP is prepared by DoE and scrutinized by MoEFCC. After that, it is appraised by the Planning Commission under the Ministry of Planning (MoP) and approved by the Project Evaluation Committee. Projects that exceed a certain amount must be approved by the Executive Committee of the National Economic Council (ECNEC) under the Cabinet Division, while others be approved by the Minister of MoP. The number of days required for the procedure is not stipulated in laws and regulations, but the period required is expected to be longer for ECNEC review.

¹ At the time of the survey, it is not envisaged that trees will be cut down to install the fixed CAMSs. The necessity of tree felling will be reconfirmed in the project implementation. If tree felling becomes necessary, the required permissions and approvals will be obtained.

2-4-3 Smooth Implementation of Projects

The following items should be implemented as necessary to ensure the smooth progress of the project.

- ✓ Assistance with customs clearance at ports in Bangladesh and, if necessary, with the domestic transportation of contractors with respect to goods transported from Japan;
- ✓ Providing Japanese nationals and/or third-country nationals staying under the project with the necessary facilities for their stay in the country for entry and performance of their work;
- ✓ Burden of customs duties, domestic taxes, and other taxes imposed by the government of Bangladesh on products and services related to the project; and
- ✓ Ensuring the transportation of participants and covering the cost of daily allowance, accommodation, etc., for the training conducted under the project.

2-4-4 Submission of Project Monitoring Reports

Project monitoring reports must be submitted before bidding and after completion of each work under the contract (shipment, delivery, installation, operation training, etc.). In addition, upon completion of the project, the project monitoring report (final version) (including construction drawings, equipment list, photographs, etc.) must be submitted.

2-4-5 Maintenance

It is necessary to properly and effectively maintain and manage the new facilities and equipment provided by the project in order to continuously acquire valid data. As for maintenance, the project will provide a set of air pollutant measurement equipment as spare parts and replacement parts (consumables) for three years, but it is necessary to secure budgets in the partner country for personnel or outsourcing costs related to maintenance and for replacement parts (consumables) thereafter. In addition, in order to implement maintenance and management more efficiently from a cost perspective, DoE needs to increase the number of DoE personnel involved in maintenance and management, with a view of having its own staff carrying out maintenance and management.

2-4-6 Other Necessary Coordination and Application Procedures

- ✓ Signing the Banking Agreement (B/A) and opening a bank account in Japan.
- ✓ Issuing the Authorization to Pay (A/P) for payments to consultants and vendors.

2-5 Project Operation Plan

2-5-1 Implementation Structures

The implementing agency for the operation and maintenance of Roadside CAMSs shall be DoE. The operation and maintenance of Roadside CAMSs can either be managed by DoE internally or outsourced to private companies. The DoE staff must be able to understand, manage, and supervise the operation and maintenance of Roadside CAMSs, even if it will be managed internally by DoE or outsourced to private companies. For this purpose, the contractor will provide initial technical guidance during the installation of Roadside CAMSs as well as technical guidance on the handling of measurement equipment and related devices during operation.

2-5-2 Implementation Methods

2-5-2-1 Operation and Maintenance of Roadside CAMSs

DoE has a document for managing existing CAMSs and C-CAMSs. After confirming if there are any missing items in the document, the addition of them will be suggested.

2-5-2-2 Operation and Maintenance of Data Center Equipment

The data from each Roadside CAMS is automatically collected by the Data Center Equipment located at the DoE headquarters. The Data Center Equipment consists of routers, USP, and workstation. These facilities are designed to operate continuously for long periods of time, so they will deteriorate over time. Failures due to aging are inevitable. The service life of Data Center Equipment is generally said to be about 10 years, so it is necessary to establish replacement standards for each facility based on the service life and to carry out systematic replacement.

2-5-2-3 Operation and Maintenance Plan for Measurement Equipment

The purpose of maintenance and inspections of measurement equipment is to keep them in good working order and obtain high-quality measurement values over a long period of time. To achieve it, a plan that outlines the contents and timing of maintenance and inspections must be created, the frequency of calibration, the timing of overhauls, and the replacement of outdated measurement equipment.

Maintenance and inspection of measurement equipment consist of the following tasks:

- ✓ Daily inspections (once every two weeks) to ensure that measurement equipment is operating correctly and obtain accurate measurement data.
- ✓ Periodic inspections (once a year) to maintain the performance measurement equipment and prevent malfunctions.
- ✓ Emergency inspections are usually performed by a manufacturer to determine the cause and take countermeasures in the event of an abnormality or failure.
- ✓ Performance tests to confirm the performance measurement equipment and the reliability of measured values.
- ✓ Overhauls.

It is important to include these inspections in the operation and maintenance plan for measurement equipment.

Additionally, some measurement equipment deteriorates over time as they are used continuously 24 hours per day for a long period of time. Even if parts are replaced during periodic inspections and the performance measurement equipment is properly maintained, breakdowns due to age-related deterioration are inevitable. Since the service life of measurement equipment is generally said to be about ten years, it is necessary to establish renewal standards for each measurement equipment and perform systematic replacements based on the service life.

2-5-2-4 Management of Other Supplies

There is no problem regarding consumables because the consumables are procured once a year without shortage. For the storage of the consumables, it is necessary to confirm that the storage conditions (temperature and humidity) are met when they are stored at the outsourcing companies.

Since the parts necessary for the measurement equipment and the time they need to be replaced vary from one to another, it is recommended to proceed with securing a budget by creating a plan for parts replacement and determining the expenses that will be required. It is also necessary to have a system that enables prompt replacement of parts in the event of a malfunction.

Among the equipment required for the operation of measurement equipment, the high-pressure gases used for calibration require safety control. Accidents that involve high-pressure gases can result in gas spurts and leaks due to high-pressure gas cylinders overturning or being destroyed, which can lead to fires, explosions, and poisoning.

The Department of Explosives regulates the use of high-pressure gases in Bangladesh, but since there are no specific rules, it is suggested that the following Japanese regulations shown in Table 2-17 be followed.

Table 2-17 Considerations for Installing and Storing High-pressure Gas Containers

Items	Matters Requiring Attention
Installation and Storage	• Keep high-pressure gas containers away from direct sunlight in a well-ventilated location. • Ensure that the storage temperature is below 40°C and differentiate between oxygen and flammable gas containers. • Keep filled containers (containers filled with gas) and empty containers (empty after use) separately. • Keep high-pressure gas containers upright. Secure them with a wedge or other means to prevent them from tipping over or falling. Ensure that the container valve is tightened and store the container with a protector or protective cap properly attached. • Do not start a fire within a two-meter radius of the storage area. Post a sign prohibiting fire and prepare a fire extinguisher. • When returning high-pressure gas containers, make sure that the container valves are completely tightened and return the containers to the distributor, leaving any remaining gases. • Even if containers have residual gases, do not leave them unattended for more than six months.

Source: Prepared by the JICA Survey Team based on the Japanese Manual for Continuous Monitoring of Air Quality (6th Edition) and the 'For Consumers of High-pressure Gas' by the High-pressure Gas Safety Institute of Kanagawa

2-5-2-5 Documents Management

To ensure proper operation and maintenance of the Roadside CAMSs, it is necessary to create an operation and maintenance plan chart, a monthly plan chart, and an annual plan chart. In addition, a format is necessary to record the details of operation and maintenance works, summarize information on measurement equipment (product information), and record inspections of measurement equipment. The soft component will take care of preparing and training the materials that are missing.

2-5-2-6 Measurement Time

As mentioned earlier, in Japan, not all measurement results are subject to evaluation. Only days that measured for at least 20 hours are considered as 'effective days of measurement' when evaluating daily averages according to the environmental standard.

In addition, the following measurement hours or effective days of measurement are required for long-term assessment of the Japanese environmental standards.

- ✓ SO₂, CO, PM₁₀ and NO₂: Measurement lasting 6,000 hours or more annually
- ✓ PM_{2.5}: 250 or more days of effective measurement per year

It is important to avoid seasonal bias in valid measurement of times or days during a year, if there is seasonal variation in measurements. The operation and maintenance must be managed in a way that ensures stable measurements over the long term.

2-6 Project Cost Estimation

2-6-1 Initial Cost Estimation

2-6-1-1 Expenses to be Borne by the Bangladesh Side

In case the project is executed under a grant aid, expenses to be borne by the Bangladesh side are shown in Table 2-18.

Table 2-18 Expenses Borne by the Bangladesh Side

Items	Cost (BDT 1000)	Exchange to JPY (JPY 1000)* ¹
Electricity/communication interconnection	1,931	2,646
B/A and A/P fees	617	845
Total	2,548	3,491

*1: The exchange rate is JPY / BDT 1.37

Source: JICA Survey Team

2-6-1-2 Condition of Estimation

2-6-1-2-1 Time of Cost Estimation

The point in time for cost estimation is May 2024, the month in which the first site survey is completed.

2-6-1-2-2 Currency Exchange Rates

For exchange from the base currency (USD) to Japanese yen, the average Telegraphic Transfer Selling (TTS) rate for the past three months (February 2024 - April 2024), starting from the last day of April 2024, the month prior to the month in which the first site survey was completed, shall be used. For the exchange from local currency (BDT) to Japanese yen, the average Telegraphic Transfer Buying (TTB) rate for the past three months (February 2024-April 2024) shall be used.

USD 1 = JPY 151.96 (TTS)

BDT 1 = JPY 1.37 (TTB)

2-6-1-3 Taxes

In the project, the Japanese consumption tax on equipment procured in Japan will not be applied because the equipment and materials are intended for export. Therefore, consumption tax has not been included in this estimation.

In addition, although the value-added tax (VAT) on equipment procured in Bangladesh is set in Bangladesh, VAT is not taken into account in the estimation of the cost to be borne by the Japanese side.

In Bangladesh, the contractors and consultants of this project are exempt from customs clearance and taxes such as VAT, etc. that are incurred in Bangladesh, and the following procedures are required.

- ✓ When importing goods procured in Japan to Bangladesh, it is necessary to pay general customs duties, VAT, and advance income tax. The implementing agency will pay these taxes directly.
- ✓ The contractor will pay the VAT on locally procured goods and installation work, and then claim it back from the implementing agency.

The implementing agency needs to secure the budget in the DPP to pay and refund the relevant taxes.

2-6-1-4 Standards of Cost Estimation to be Applied

In estimating the cost of the project, the cost estimation standard and materials shown in Table 2-19 shall be used.

Table 2-19 Cost Estimation Standards

No	Standard of const estimation	Note
1	Manual of Cost Estimation for Preparation Survey (Trial Version), March 2009	JICA
2	Manual of Cost Estimation for Preparation Survey (Civil Works), April 2023	JICA
3	Manual of Cost Estimation for Preparation Survey (Equipment), April 2024	JICA

Source: JICA Survey Team

2-6-1-5 Price Escalation

This cost estimation does not take into account price escalations.

2-6-2 Operation and Maintenance Cost

The estimate of operation and maintenance costs for Roadside CAMSs, measurement equipment, ancillary equipment, and Data Center Equipment to be installed in the project was made using the useful life of the measurement equipment (ten years of use is possible with proper operation and maintenance), considering the inflation rates. The approximate results are shown in Table 2-20. The cost of operation and maintenance is a rough estimate, as the frequency of replacement will vary depending on the equipment and parts to be selected and procured in the future. The operation and maintenance costs were tabulated using the following categories:

- ✓ Roadside CAMSs and ancillary equipment: To prevent rainwater from entering Roadside CAMSs, Roadside CAMSs need to be completely painted, the sealing needs to be replaced, and the door gaskets need to be replaced every six years. The UPS, communication equipment, and routers will also need to be replaced every 5 to 8 years.
- ✓ Data Center Equipment: In the initial phase, no maintenance costs are required, but around the fifth year, replacement costs for a router, a UPS, and telecommunications equipment will be incurred.
- ✓ Consumables and replacement parts for measurement equipment: Costs of consumables and parts for measurement equipment, calibration gases, and pressure regulators.
- ✓ Costs for outsourcing companies: DoE has outsourced the operation and maintenance of the existing CAMSs and C-CAMSs. Similarly, personnel and transportation costs are required for outsourcing the operation and maintenance of eight Roadside CAMSs to be developed under the project. The current outsourcing includes:
- ✓ Daily inspections (once every two weeks) involve inspecting ancillary equipment and measurement equipment at the existing CAMSs and C-CAMSs, confirmation of the operational status of measurement equipment, replacement of consumables and simple parts in measurement equipment, calibration of measurement equipment using calibration gases, cleaning of simple parts of measurement equipment, and checking the availability of spare parts and consumables for measurement equipment;
- ✓ Confirmation of measured values by checking them daily at the consignee's office and reporting any abnormalities to DoE;
- ✓ Emergency inspections; and
- ✓ Comprehensive maintenance once a year.
- ✓ Periodic inspections by a manufacturer or distributor of measurement equipment: Periodic inspections (precision inspections) by a manufacturer or distributor are required at least once a year to maintain the performance of measurement equipment and prevent malfunctions. Manufacturer engineers are the only ones who can perform periodic inspections, which involve calibrating measurement equipment to check their

- measurement accuracy, inspecting their characteristics, and replacing deteriorated parts. Users cannot perform these inspections due to the high level of skill and judgment required. The primary inspection items are inspections of the flow path, detection section, control and transmission system, amplifiers, and recorders. Existing CAMSs and C-CAMSs also undergo periodic inspections once a year by the measurement equipment manufacturers.
- ✓ Emergency inspections and overhauls: Emergency inspection costs in case of abnormalities or breakdowns, and overhaul costs if there is a significant increase in missed measurement time due to measurement equipment breakdown or difficulty maintaining measurement accuracy only through periodic inspections.

The DoE's current budget for existing CAMSs and C-CAMSs operation and maintenance is approximately BDT 40 million. When comparing this budget size to the estimated operation and maintenance costs, it is assessed that the operation and maintenance costs will be less than 10% in the first year and less than 50% by the third year. Starting from the fourth year, operation and maintenance expenses will be equal to or even surpass the current budget size, depending on the year. For the first three years after installation, the budget required by DoE will be lower than the annual budget for existing CAMSs because consumables and replacement parts, and spare equipment are included in the project. Therefore, DoE will need to secure additional budgetary resources. In addition, the project includes replacement calibration gas, but because it has a consumption period, it is set at two years. Therefore, in the third year, it is necessary to procure replacement calibration gas from DoE, and the cost of this is included.

The estimate includes the expense of outsourcing the operation and maintenance of Roadside CAMSs, but the cost can be decreased if DoE staff performs it internally. It is also important to obtain appropriate measurement data over time through proper operation and maintenance.

The useful life of Roadside CAMSs is 20 years. If the initial measurement equipment to be installed are replaced and monitoring is continued, the ancillary equipment will also need to be updated. A huge budget would be necessary to implement equipment renewal all at once. The budget can be balanced from year to year by purchasing measurement equipment systematically over multiple years, even before the measurement equipment are due for renewal.

DoE will be given a clear understanding of the costs required for the operation and maintenance of Roadside CAMSs and measurement equipment by the JICA Survey Team after the project is completed, and they will be supported in obtaining a budget as part of the soft component of the project.

Table 2-20 Estimation of Operation and Maintenance Costs (thousand JPY)

Item	1 st year	2 nd year	3 rd year	4 th year	5 th year	6 th year	7 th year	8 th year	9 th year	10 th year
Roadside CAMSs and ancillary equipment	213	132	139	146	155	1,673	5,722	22,761	192	203
Data Center Equipment	0	0	0	0	0	177	0	2,274	20,043	0
Consumables and replacement parts for measurement equipment	0	0	7,119	14,336	19,996	25,000	22,815	15,516	25,185	18,279
Costs for outsourcing companies	7,945	8,381	8,842	9,328	9,841	10,382	10,953	11,556	12,192	12,862
Periodic inspections by a manufacturer and a distributor of measurement equipment	0	8,189	8,354	8,520	8,691	9,988	9,042	9,223	9,407	9,595
Total (BDT)	8,158	16,702	24,454	32,330	38,683	47,220	48,532	61,330	67,019	40,939

Note: To account for price increases over time, the IMF-issued inflation rates were used as a reference (Bangladesh inflation rate: 5.5-6.1%; Japan inflation rate: 2.2-2.1%).

(<https://www.imf.org/en/Countries/BGD> and <https://www.imf.org/en/Countries/JPN> (as of August 23, 2024))

The sixth, seventh, and eighth years of the building and ancillary facilities of the Roadside CAMSs will require the replacement of communication equipment, repainting of the entire building, re-sealing, replacement of door seals, and replacement of the UPS. The ninth year of the Data Center Equipment will require the replacement of communication equipment.

Emergency inspections and overhaul costs are not included in the above table.

Source: JICA Survey Team

Chapter 3 Project Evaluation

3-1 Preconditions

As a precondition of the project, DoE must secure enough budget for a proper operation and maintenance of the Roadside CAMSs. Currently, DoE does not have enough budget for the operation and maintenance of the existing CAMSs established by the World Bank. Appropriate operation and maintenance are inevitable for a reliable data collection.

Government lands will be used for the site to install the Roadside CAMSs, with no land acquisition in the project. In this survey, the JICA Survey Team supported DoE to obtain permission from the landowners to use their lands. For the next step, further discussions are required between DoE and each landowner to reach official agreements and ensure that the lands can be used for the Roadside CAMSs. If the landowner requests to move the Roadside CAMSs out, a new site must be found and secured by DoE to resettle the Roadside CAMSs.

3-2 Necessary Inputs by Recipient Country

In order to accomplish the project, the items of obligation of the recipient country as described in 2-4 will need to be implemented, and consultants and contractors will need to work together to advance the project.

In addition, as described in 2-5, the counterpart country must secure a site for the Roadside CAMSs, secure operation and maintenance costs, and establish an operation and maintenance structure. In the project, seven fixed CAMSs and one on-vehicle CAMS will be installed as measuring stations, and replacement parts and consumables that will be needed for three years after installation will be installed. After the completion of the project, although replacement parts and consumables will be available, it will be necessary to consider securing a budget and establishing a system to continuously maintain and manage the measuring stations. DoE will bear all the necessary costs for maintenance and management.

3-3 Important Assumptions

Public safety in the project area should never be compromised. In addition, the policies related to air pollution control and the implementation system of the project shall be maintained after the change of the government of Bangladesh after August 2024.

Regarding synergies with other projects, the Technical cooperation project (Air Quality Management Capacity Improvement Project) scheduled to be implemented by JICA from 2025 to 2029 and the Bangladesh Environmental Sustainability and Transformation (BEST) Project by the World Bank should be taken into consideration. In the JICA technical cooperation project, an efficient and effective use of the Roadside CAMSs will be considered, based on the operation and maintenance system, which will be established in the project. In the BEST project by the World Bank, some new vehicle inspection centers will be established, which will expectedly promote the measures to decrease vehicle emissions, and the Roadside CAMSs installed in the project can be used to evaluate the effects of those measures.

3-4 Project Evaluation

3-4-1 Relevance

The Government of Bangladesh has positioned the improvement of the atmospheric environment as an urgent issue in its 8th Five-Year Plan (2020/21-2024/25), setting a target of reducing PM_{2.5} concentrations (annual average) to 60 µg/m³ by 2025. This plan only mentions the stipulation of air quality management guidelines, except countermeasures to the gas emissions from brick kilns. The plan also mentions that air pollution is the main environmental problem in urban areas, such as Dhaka and Chattogram, and the main cause of air pollution in urban areas is the increase in number of vehicles. Considering that there are no Roadside CAMSs currently in Bangladesh, it will be worthwhile and valid to install the Roadside CAMSs to monitor the effects of vehicle

emissions.

Furthermore, Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC) drafted the “Dhaka City Air Pollution Control Action Plan (Dhaka City Blue Sky Action Plan)” in 2024. This draft is currently under review by MoEFCC. This action plan states that vehicle emission is one of the main causes of air pollution in Dhaka City and sets continuous air quality monitoring with the Roadside CAMSs as one of their action plans. The project aligns with this action plan as well.

3-4-2 Effectiveness

Table 3-1 and Table 3-2 show the expected quantitative and qualitative effects of the project.

Table 3-1 Expected Quantitative Effects

Effects	Current Situation (in 2023)	Target (in 2030/in three years after project completion)
Annual hourly data acquisition rate for each pollutant by the Roadside CAMS (hour/year ^{*1})	0	6,000
Publish an annual report of the data monitored with the Roadside CAMSs on the DoE website (times/year)	0	1 ^{*2}
The number of times the air quality data acquired through the project is used in measures such as air pollution control rules	0	1 ^{*3}

*1 The criteria for determining whether a station is an “effective station” for Japan's continuous observation are based on the reference time. The criteria are determined for each measurement item. The aim is to achieve continuous measurement at each of the seven new Roadside CAMSs to be established as part of the project. (On-vehicle CAMS is not included in the above table because their main purpose is to provide backup in the event of a breakdown, etc., and they do not measure at fixed points at all times.)

*2 Expecting to publish an annual report with data monitored in a year (Status of satisfaction of the environmental standards, study of seasonal fluctuations, etc.)

*3 It must be used in at least one measure by 2030.

Source: JICA Survey Team

Table 3-2 Expected Qualitative Effects

Effects	Details
Improvement of the monitoring data quality of the Roadside CAMSs	Proper operation and maintenance will improve the monitoring data quality of the Roadside CAMSs.
Improvement of DoE's capacity to analyze the monitoring data with the Roadside CAMSs	DoE's capacity to interpret and analyze the monitoring data will be enhanced through the soft components.
Promoting the study of measures to combat Roadside air pollution based on air quality measurement results*	Lines and sections where air quality pollution countermeasures should be prioritized can be identified, and countermeasures can be considered.

* It can be achieved if the existing CAMSs data can be also taken into consideration in the upcoming JICA technical cooperation project

Source: JICA Survey Team

The abovementioned effects will help DoE monitor and analyze air quality to create reasonable environmental standards and policies regarding gas emissions from vehicles, which will lead to an improvement of the air quality in Bangladesh. Therefore, it is expected that the project will be highly valid and effective.

Appendices

1. Member List of the Survey Team
2. Study Schedule
3. List of the concerned organizations
4. Minutes of Discussion (M/D)
5. Soft Component (Technical Assistance) Plan
6. Outline Design Drawings

Appendix-1

Member List of the Survey Team

Appendix 1: Member list of the Survey Team

No.	Name	Position	Affiliation
1	Hiroaki TAKIGUCHI	Leader	Senior Advisor Global Environment Department Japan International Cooperation Agency
2	Takafumi YASUMOTO	Planning management	Deputy Director, Team 1 Environment Management and Climate Change Group Global Environment Department Japan International Cooperation Agency
3	Satoshi MIYAICHI	Team leader of the JICA Survey Team/ Air quality monitoring/ Monitoring planning	Nippon Koei Co., Ltd.
4	Masahito TAKAHASHI	Deputy team leader of the JICA Survey Team/ Equipment planning 2 (Before 2023/12/26)	Nippon Koei Energy Solutions Co., Ltd.
5	Takao TSUCHIYA	Deputy team leader of the JICA Survey Team/ Equipment planning 2 (After 2023/12/27)	Nippon Koei Energy Solutions Co., Ltd.
6	Muneo MATSUKAWA	CAMS siting planning/ Equipment planning 1	Japan Weather Association
7	Shinji TANAKA	Implementation structure	Nippon Koei Co., Ltd.
8	Hisako OMAGARI	Operation and maintenance planning	Japan Weather Association
9	Yuki KAMIYAMA	Procurement planning/ Cost estimation	Nippon Koei Energy Solutions Co., Ltd.
10	Tatsuya NAGINO	Air quality monitoring assistant	Nippon Koei Co., Ltd.

Appendix-2
Study Schedule

Appendix 2: Study Schedule

No.	Name	Schedule	Outline of the survey
1	TAKIGUCHI	2023/8/15-8/25	1st mission (Outline Design), signing M/D
	YASUMOTO	2023/8/15-8/25	
	MIYAICHI	2023/7/29-9/6	Joining the 1st mission, surveys listed in the below
	TAKAHASHI	2023/8/15-9/1	
	MATSUKAWA	2023/7/29-9/2	Document/ site survey to select the candidate site of CAMS, discussions with C/P and concerned organizations, on-site confirmation, visiting the existing CAMS, surveys for equipment planning, etc.
	OMAGARI	2023/8/12-8/26	
	NAGINO	2023/7/29-9/16	
2	MIYAICHI	2023/12/3-12/23	Discussions with C/P, negotiation with the landowners
3	MIYAICHI	2024/2/5-3/8	Ditto
	TSUCHIYA	2024/2/3-3/10	Discussions with C/P, surveys for designing, equipment planning, procurement planning, cost estimation, etc.
	KAMIYAMA	2024/2/12-3/30	
4	MIYAICHI	2024/5/4-5/23	Discussions with C/P, negotiation with the landowners
	TSUCHIYA	2024/5/18-5/29	Discussions with C/P, surveys for designing, equipment planning, procurement planning, cost estimation, and topographic survey, etc.
5	TAKIGUCHI	2024/8/31-9/7	2nd mission (Explanation on Draft Preparatory Survey Report), signing M/D
	YASUMOTO		Joining the 2nd mission
	MIYAICHI		
	TSUCHIYA		
	MATSUKAWA		
6	KAMIYAMA	2024/9/21-10/5	Discussions with C/P, assisting the preparation of DPP

Appendix-3

List of the concerned organizations

Appendix 3: List of the concerned organizations

Organization	Name	Position
Economic Relations Divisions (ERD) *Ministry of Finance (MoF)	Mr. A. K. M Shahabuddin	Additional Secretary (America and Japan Wing)
	Ms. Khadija Parveen	Joint Secretary (Branch: Japan)
Ministry of Environment, Forests and Climate Change (MoEFCC)	Mr. A S M Humayun Kabir	Additional Secretary (Development Wing)
	Ms. Fatima Tuz Zohora	Deputy Secretary (Planning-6)
Department of Environment (DoE) *Ministry of Environment, Forests and Climate Change (MoEFCC)	Dr. Abdul Hamid	Director General
	Mr. Md. Ziaul Haque	Director (Air Quality Management Wing)
	Dr. Mohammad Abdul Motalib	Deputy Director (Air Quality Management Wing)
	Ms. Shahanaj Rahman	Deputy Director (Air Quality Management Wing)
	Ms. Nasim Farhana Shireen	Director (Chattogram Laboratory)
	Mr. Md Kamrul Hasan	Deputy Director (Chattogram Laboratory)

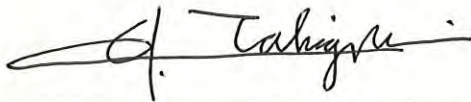
Annex-4

Minutes of Discussion (M/D)

Minutes of Discussions
on the Preparatory Survey for the Project for
Improvement of Equipment of Air Pollution Monitoring

Based on the several preliminary discussions between the Government of the People's Republic of Bangladesh (hereinafter referred to as "Bangladesh") and Embassy of Japan in Bangladesh and JICA Bangladesh Office, 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 Improvement of Equipment of Air Pollution Monitoring (hereinafter referred to as "the Project") to Bangladesh. The Team held a series of discussions with the officials of the Government of Bangladesh and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

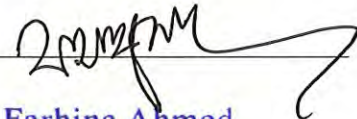
Dhaka, 12th September 2023



Dr. Takiguchi Hiroaki
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan



Dr. Abdul Hamid
Director General
Department of Environment
Ministry of Environment, Forests and
Climate Change
The People's Republic of Bangladesh



Dr. Farhina Ahmed
Secretary
Ministry of Environment, Forest and Climate Change
Govt. of the People's Republic of Bangladesh

Ministry of Environment, Forests and
Climate Change
The People's Republic of Bangladesh

ATTACHMENT

1. Objective of the Project

The objective of the Project is to enhance the capacity to measure and analyze air pollutants derived mainly from vehicle emissions by setting up Continuous Air Monitoring Stations (CAMS) for analyzing the impact of vehicle emissions in Bangladesh, thereby contributing to the enhancement of air pollution control capacity.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “The Preparatory Survey for the Project for Improvement of Equipment of Air Pollution Monitoring”.

3. Project site

Both sides confirmed that the sites of the Project are in Dhaka and Chattogram.

4. Responsible authority for the Project

Both sides confirmed their responsibilities under the Project are as follows:

4-1. The Department of Environment (hereinafter referred to as “DoE”), Ministry of Environment, Forests and Climate Change (hereinafter referred to as “MoEFCC”) will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency under the guidance of MoEFCC 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 1.

4-2. The line ministry of the Executing Agency is the MoEFCC. The MoEFCC shall be responsible for supervising the Executing Agency on behalf of the Government of Bangladesh.

5. Items requested by the Government of Bangladesh

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Bangladesh are as follows:

-Equipment

Six CAMS (consisting of air quality meters, meteorological instruments, etc.) on the roadside of the project site as stipulated clause-3 with high traffic volume

-Consulting Services with the legal provisions of both parties

Detailed design, bidding support, procurement supervision, equipment installation supervision

-Soft component

Guidance for operation and maintenance of CAMS

5-2. 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.

5-3. The Government of Bangladesh shall submit an official request to the Government of Japan through a diplomatic channel before the end of November, 2023.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Bangladesh side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as "the Grant") as described in Annex 2 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires the Bangladesh side to submit the Project Monitoring Report, the form of which is attached as Annex 3.

6-2. The Bangladesh side agreed to take the necessary measures, as described in Annex 4, for smooth implementation of the Project. The contents of the Annex 4 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 4 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 Bangladesh until the beginning of October, 2023.

7-2. The official request to the Government of Japan will be submitted before the end of November, 2023.

7-3. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Bangladesh in order to explain its contents around January, 2024.

7-4. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Bangladesh side, JICA will finalize the Preparatory Survey Report and send it to Bangladesh around June, 2024.

7-5. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Bangladesh 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 (January, 2022).

8-2. The Project is categorized as “C” from the following considerations:

The project is likely to have minimal adverse impact on the environment under the JICA guidelines for environmental and social considerations (January, 2022).

9. Important Issues

9-1. Land use approval for sites for CAMS

- MoEFCC and DoE agreed to start the coordination through the Government of Bangladesh’s official procedure (official letters and meetings, etc.) of land use approval for candidate sites for CAMS to the authorities concerned after the signing of the M/D immediately.
- MoEFCC and DoE also agreed to report the progress of coordination and prospects of the land use approval from the authorities concerned for sites for CAMS to JICA Bangladesh office by the end of November, 2023.
- Depending on the prospects of the land use approval in the above report, JICA can determine the timing and possibility of the mission for explanation of draft Preparatory Survey Report.
- MoEFCC, DoE and JICA recognized that land use approval needs to be confirmed before the signing of Grant Agreement.

9-2. The number of candidate sites for CAMS

Both sides recognized that approximately eight candidate sites would be necessary because the negotiation with the authorities concerned is not straightforward.

9-3. Consumables and spare parts

DoE requested JICA for supplying consumables and spare parts for the period of three years as operation and maintenance support. JICA will consider it.

9-4. Compatibility with the existing monitoring system

The data collected by the equipment should be transmitted in a format that can be managed by the existing monitoring system operated by DoE.

9-5. On-Vehicle CAMS

DoE suggested that the application of On-Vehicle CAMS should be considered in the study. JICA will consider it.

10. Other Relevant Issues

10-1. Development Project Proposal/Technical Assistance Project Proposal

MoEFCC and DoE agreed to develop and approve Development Project Proposal//Technical Assistance Project Proposal (hereinafter referred to as "DPP/TAPP") before the signing of the Grant Agreement.

10-2. Tax exemption

Both sides confirmed the possibility of availing the mechanism and procedure of tax exemption. The tax exemption includes Value Added Tax (VAT), custom duty, and any other taxes and fiscal levies in Bangladesh, which is to be arisen from the project activities. The Executing Agency with the guidance of MoEFCC shall take necessary measures for tax exemption at their responsibility, preferably by keeping budget in DPP/TAPP to realize the taxes and VAT.

10-3. Security measures

Both sides confirmed that the Executing Agency in support with concern authorities, shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities during the Project period. Such security measures shall reasonably reflect needs of the Consultant/the Contractor engaging in the Project.

10-4. Gender mainstreaming

Both sides confirmed that following gender elements shall be duly reflected in the scope of Preparatory Survey.

(a) Collection of information for assessment of gender mainstreaming needs.

(b) Examination of gender-responsive measures based on the assessment, such as the percentage of female engineers in the trainers and the trainees of the operation and maintenance skills for CAMS.

Annex 1 Organization Chart

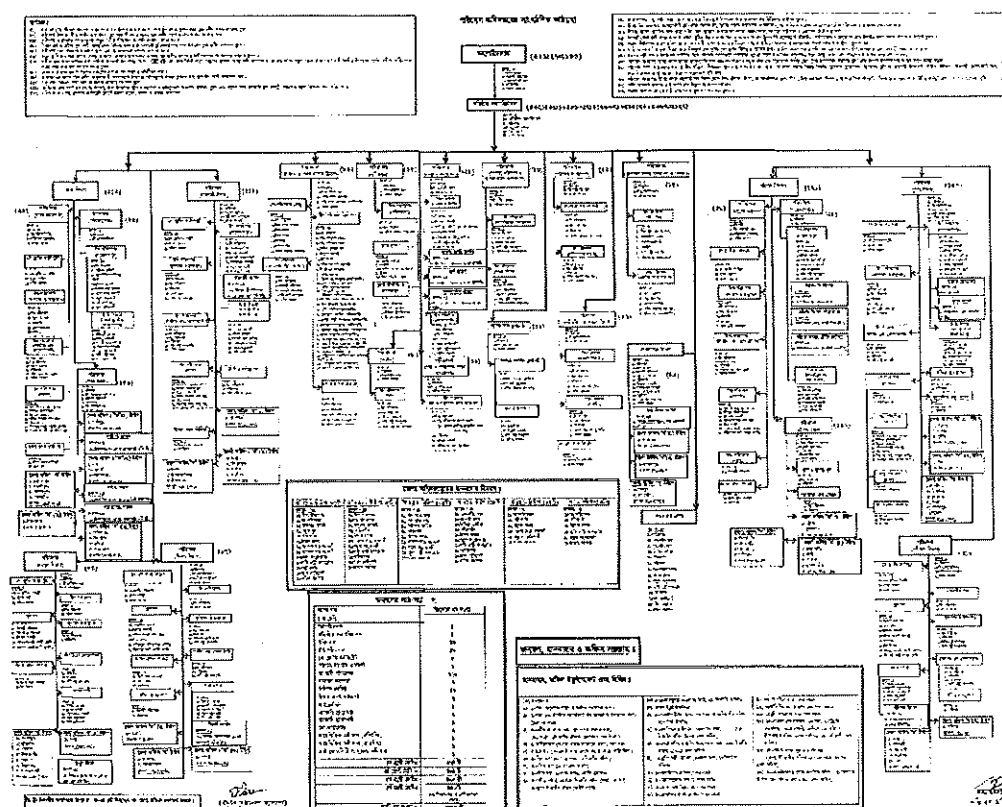
Annex 2 Japanese Grant

Annex 3 Project Monitoring Report (template)

Annex 4 Major Undertakings to be taken by the Government of Bangladesh

Organization Chart

Department of Environment, Ministry of Environment, Forests and Climate Change



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 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

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

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) Measures to ensure more efficient implementation of the Grant

- i) In the event that the E/N and the G/A concerning a project cannot be signed by the end of the following Japanese fiscal year of the cabinet decision concerned by the GOJ, the authorities concerned of the two Governments will discuss the cancellation of the project.

ii) In the event that the period, specified in the G/A, during which the grant is available expires before the completion of the disbursement, the authorities concerned of the GO J will thoroughly review the status, situation and perspective of the implementation of the project concerned before extending the said period. The authorities concerned of the two Governments will discuss the termination of the project including a refund, unless there are concrete prospects for its completion.

iii) Regardless of the period mentioned in ii) above, the authorities concerned of the two Governments will, in the event that five years have passed since the cabinet decision concerned by the GOJ before the completion of the disbursement, except as otherwise confirmed between them, discuss the termination of a project including a refund, unless there are concrete prospects for its completion.

4) 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.

5) Export and Re-export

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

PROCEDURES OF JAPANESE GRANT

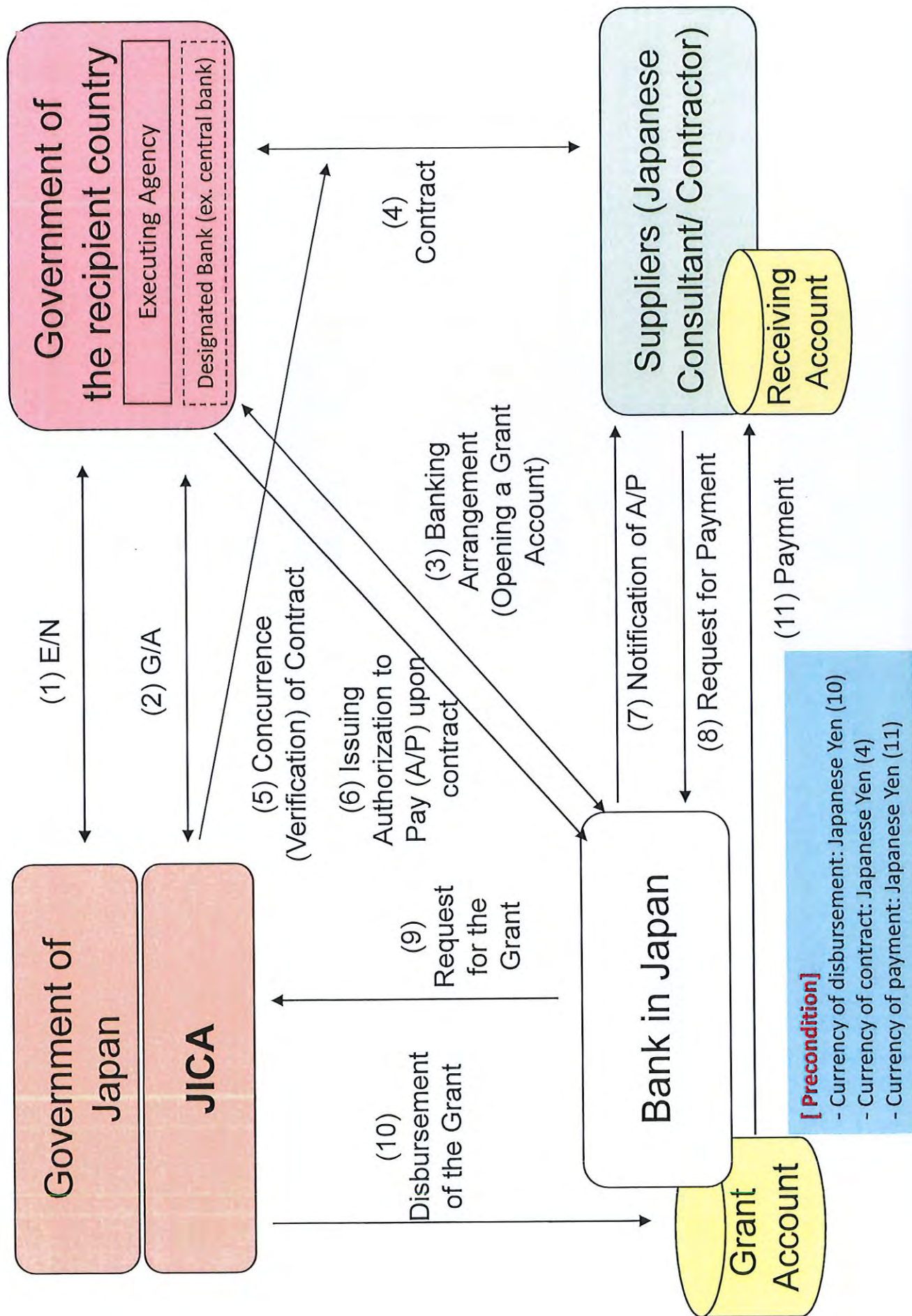
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
4. Ex-post monitoring & evaluation	(14) Completion certificate		x			x	x	
	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)



<u>Project Monitoring Report</u> on <u>Project Name</u> <u>Grant Agreement No. XXXXXXXX</u> 20XX, Month
--

Organizational Information

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

General Information:

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

1: Project Description

1-1 Project Objective

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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 (proposed in the outline design)	Actual
1.		

2-2 Scope of the work

Components	Original* (proposed in the outline design)	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

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

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 (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	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 (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
	1.			

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.

Original (at the time of outline design)

name:

role:

financial situation:

institutional and organizational arrangement (organogram):

human resources (number and ability of staff):

Actual (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.)

Original (at the time of outline design)

Actual (PMR)

3-2 Budgetary Arrangement

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

Original (at the time of outline design)

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:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures (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.

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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. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final) only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)
12. Report on the Management of Safety for Construction Works

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

Items of Specified Materials		Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C-D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

Items of Specified Materials		1st month, 2015	2nd month, 2015	3rd month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

-
-
-

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%)	

Report on the Management of Safety for Construction Works

Month/Year 2022 年 × 月	Cumulative number of labor 労働延人数	Cumulative number of public accident 公衆災害件数	Cumulative hours worked 延べ実労働時 間数	Number of deaths and injuries due to industrial accidents 労働災害による死傷者				Frequency rate 度数率	Severity rate 強度率
				Death and injuries 死傷者数	Aggregated number of calendar days absent 延べ休業日数	Aggregated number of work- days lost 延べ労働損失日数			
This Month 当月				Death 死者					
				More than 4 calendar days absent 休業 4 日以上					
				1 to 3 calendar days absent 休業 1～3 日					
				Total 計					
Total including this month 当月迄累計				Death 死者					
				More than 4 calendar days absent 休業 4 日以上					
				1 to 3 calendar days absent 休業 1～3 日					
				Total 計					
Note 注)				1. Frequency rate is the frequency of occurrence of industrial accidents. 度数率 = (Number of deaths and injuries due to industrial accidents ÷ Cumulative hours worked) × 1,000,000 度数率 = (労働災害による死傷者数 ÷ 延べ実労働時間数) × 100 万時間 2. Severity rate is degree of seriousness of the industrial accident. 強度率 = (Aggregated number of work-days lost ÷ Cumulative hours worked) × 1,000 強度率 = (延べ労働損失日数 ÷ 延べ実労働時間数) 1000 時間 3. Aggregated number of work-days lost = Aggregated number of calendar days absent × (300 ÷ 365) Death (7,500 days) : death as a result of an industrial accident includes not only instantaneous death but also death as a result of occupational injury or disease. 延べ労働損失日数 = 延べ休業日数 × (300 ÷ 365) ・ ・ ・ 死亡 7500 日 (即死のほか、負傷が原因で死亡したものを含む) 4. Frequency rate and severity rate are rounding off the third decimal place. 度数率・強度率は小数点第 3 位以下四捨五入					

Major Undertakings to be taken by the Government of Bangladesh

1. Specific obligations of the Government of Bangladesh which will not be funded with the Grant**(1) Before the draft Final Preparatory Survey mission**

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To report the progress of coordination and prospects of the land use approval from the authorities concerned for sites for the project sites	before the end of November, 2023	MoEFCC DoE		

(2) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	MoEFCC DoE		
2	To issue A/P to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	MoEFCC DoE		
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	MoEFCC DoE		
	2) Payment commission for A/P	every payment	MoEFCC DoE		
4	To secure the necessary budget for land use for the project sites	before notice of the bidding documents	DoE		
5	To secure the land use approval for the project sites	before notice of the bidding documents	DoE		
6	To obtain the planning, zoning, building permit	before notice of the bidding documents	DoE		
7	To clear, level and reclaim the project sites	before notice of the bidding documents	DoE		
8	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding documents	DoE		

(3) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
----	-------	----------	-----------	----------------	------

1	To issue A/P to the Agent Bank for the payment to the supplier and the contractor	within 1 month after the signing of the contract(s)	MoEFCC DoE		
2	To bear the following commissions to the Agent Bank 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)	MoEFCC DoE		
	2) Payment commission for A/P	every payment	MoEFCC DoE		
3	To ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	DoE		
4	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	DoE		
5	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 borne by its designated authority without using the Grant	during the Project	DoE		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	DoE		
7	To ensure the safety of persons engaged in the implementation of the Project	during the Project	DoE		
8	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction/ installation	DoE		
9	To construct access roads outside the sites	3 months before completion of the construction	DoE		
10	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites				
	1) Electricity The distributing line to the site	before start of the construction	DoE		
	2) Water Supply The city water distribution main to the site	before start of the construction	DoE		
	3) Drainage The city drainage main (for storm, sewer and others) to the site	before start of the construction	DoE		
11	1) To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within 1 month after completion of each work	DoE		
	2) To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	DoE		
12	To submit a notice concerning completion of the Project	within 6 months after completion of the Project	DoE		

(4) 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/ installation	DoE		

Minutes of Discussions
on the Preparatory Survey for the Project for
the Improvement of Equipment for Air Pollution Monitoring
(Explanation on Draft Preparatory Survey Report)

With reference to the minutes of discussions signed between the Department of Environment, Ministry of Environment, Forests and Climate Change and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 12th March, 2024 and in response to the request from the Government of the People's Republic of Bangladesh (hereinafter referred to as "Bangladesh") dated 12th September, 2023, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") for the Project for the Improvement of Equipment for Air Pollution Monitoring (hereinafter referred to as "the Project").

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Dhaka, 12 September, 2024

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ATTACHEMENT

1. Objective of the Project

The objective of the Project is to enhance the capacity to measure and analyze air pollutants derived mainly from vehicle emissions by setting up Continuous Air Monitoring Stations (CAMS) for analyzing the impact of vehicle emissions in Bangladesh, thereby contributing to the enhancement of air pollution control capacity.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as follows:

【Original】

The Preparatory Survey for the Project for Improvement of Equipment of Air Pollution Monitoring

【Amendment】

The Preparatory Survey for the Project for the Improvement of Equipment for Air Pollution Monitoring

3. Project site

Both sides confirmed that the project sites are in Dhaka North City, Dhaka South City and Chattogram City as shown in Annex 1.

The list of the roadside CAMSs installation sites is as follows:

-No.1

City : Dhaka North City
Address : Sector 8, Uttra, Dhaka - Mymensingh Hwy, Dhaka
Landowner : Sadharan Bima Corporation (SBC)
Line Ministry : Financial Institutions Division (FID), Ministry of Finance (MoF)

-No.2

City : Dhaka North City
Address : Hatirjheel Bridge, Hatir Jheel Link Rd, Dhaka
Landowner : Dhaka Water Supply and Sewerage Authority (DWASA)
Line Ministry : Local Government Division (LGD), Ministry of Local Government, Rural Development and Cooperatives (MoLG,RDC)

-No.3

City : Dhaka North City
Address : Road No. 27, Block-A, Dhaka - Mymensingh Highway, Dhaka
Landowner : Roads and Highways Department (RHD)

Line Ministry : Road Transport And Highways Division (RTHD)

-No.4

City : Dhaka South City

Address : Dr. Quadrat-I-Khuda Road, Dhanmondi, Dhaka

Landowner : Bangladesh Council of Scientific and Industrial Research (BCSIR)

Line Ministry : Ministry of Science and Technology (MoST)

-No.5

City : Dhaka South City

Address : Dhaka-Chattogram Highway, N1, Jatrabari Intersection

Landowner : Dhaka South City Corporation (DSCC)

Line Ministry : Local Government Division (LGD), Ministry of Local Government,
Rural Development and Cooperatives (MoLG,RDC)

-No.6

City : Chattogram City

Address : M. A. Aziz Road, Saltgola, Chattogram

Landowner : Chattogram Development Authority (CDA)

Line Ministry : Ministry of Housing and Public Works (MoHPW)

-No.7

City : Chattogram City

Address : Chattogram Cantonment, Chattogram-4220

Landowner : Bangladesh Council of Scientific and Industrial Research (BCSIR)
- Chattogram

Line Ministry : Ministry of Science and Technology (MoST)

4. Responsible authority for the Project

Both sides confirmed their responsibilities under the Project are as follows:

4-1. The Department of Environment (hereinafter referred to as "DoE"), Ministry of Environment, Forests and Climate Change (hereinafter referred to as "MoEFCC") will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency under the guidance of MoEFCC 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. The line ministry of the Executing Agency is the MoEFCC. The MoEFCC shall be

responsible for supervising the Executing Agency on behalf of the Government of Bangladesh.

5. Contents of the Draft Report

After the explanation of the contents of the Draft Report by the Team, the Bangladesh side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Bangladesh side around December 2024.

6. Cost estimate

Both sides confirmed that the cost estimate explained by the Team is provisional and will be examined further by the Government of Japan for its approval.

7. Confidentiality of the cost estimate and technical specifications

Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

8. Procedures and Basic Principles of Japanese Grant

The Bangladesh side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as “the Grant”) as described in Annex 3 shall be applied to the Project. In addition, the Bangladesh side agreed to take necessary measures according to the procedures.

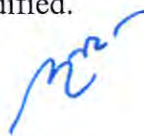
9. Timeline for the project implementation

The Team explained to the Bangladesh side that the expected timeline for the project implementation is as attached in Annex 4.

10. Expected indicators

The Bangladesh side will be responsible for the achievement of agreed key indicators targeted in year 2029 as mentioned in the following table and shall monitor the progress for Ex-Post Evaluation based on those indicators.

*The following indicators may be modified.



[Quantitative indicators]

Effects	Current situation (in 2023)	Target (in 2029) *3 years after project completion
Annual hourly data acquisition rate for each pollutant by roadside CAMS	0 hour/year	$\geq$ 6,000 hours/year
Publish an annual report of the data monitored with the roadside CAMSs on the DoE website	0 time/year	1 time/year

[Qualitative indicators]

- Improvement of the monitoring data quality of the roadside CAMSs
- Improvement of DoE's capacity to analyze the monitoring data of the roadside CAMSs
- To be able to consider countermeasures to air pollution caused by vehicle emissions more effectively using the monitoring data of the roadside CAMSs.

11. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to six evaluation criteria (Relevance, Coherence, Effectiveness, Efficiency, Impact, Sustainability). The result of the evaluation will be publicized. The Bangladesh side is required to provide necessary support for the data collection.

12. Technical assistance ("Soft Component" of the Project)

Considering the sustainable operation and maintenance of the products and services granted through the Project, following technical assistance is planned under the Project. The Bangladesh side confirmed to deploy necessary number of counterparts who are appropriate and competent in terms of its purpose of the technical assistance as described in the Draft Report.

13. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 5. With

regard to exemption/payment by the Executing Agency of customs duties, internal taxes and other fiscal levies as stipulated in 1 (2) 5, 6 of Annex 5, both sides confirmed that such customs duties, internal taxes and other fiscal levies, which shall be clarified in the bid documents by MoEFCC/DoE during the implementation stage of the Project.

The Bangladesh side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

Both sides also confirmed that the Annex 5 will be used as an attachment of G/A.

14. Monitoring during the implementation

The Project will be monitored by the Executing Agency and will send report to JICA by using the form of Project Monitoring Report (PMR) attached as Annex 6. The timing of submission of the PMR is described in Annex 5.

15. Project completion

Both sides confirmed that the project completes when all the facilities constructed and equipment procured by the Grant are in operation. The completion of the Project will be reported to JICA promptly by the Executing Agency, but in any event not later than six months after completion of the Project.

16. Items and measures to be considered for the smooth implementation of the Project

Both sides confirmed the items and measures to be considered for the smooth implementation of the Project as follows:

16-1. Assurance of land use for the Project

16-1-1. Land use approval letter

MoEFCC/DoE agreed that MoEFCC/DoE shall obtain the land use approval letter from the landowner for No. 2 Site (landowner : DWASA) and No. 6 Site (landowner : CDA) as soon as possible, by the signing of the G/A at the latest.

16-1-2. Land use MoU (Memorandum of Understanding)

In addition to Clause 16-1-1 above, the Team advised that it would be desirable for DoE and each landowner to agree on the duration of land use, advance notice period for relocation requests, etc. MoEFCC/DoE stated that they intend to enter into a Memorandum of Understanding (MOU) with each landowner. The Team requested,

and MoEFCC/DoE agreed that this process be initiated at the earliest opportunity.

16-2. Development Project Proposal/Technical Assistance Project Proposal

For allocation of the required budget for the project, Development Project Proposal (DPP) for the project is to be prepared by DoE and to be submitted to the Competent Authorities for approval according to the necessary procedures of the Government of Bangladesh.

16-3. Tax exemption/payment

Both sides confirmed the possibility of availing the mechanism and procedure of tax exemption/payment by the Executing Agency. The customs duties, internal taxes and other fiscal levies that may be imposed in Bangladesh with respect to the purchase of products and/or services shall be exempted or borne by the Government of Bangladesh. The Executing Agency under the guidance of MoEFCC shall take necessary measures for tax exemption/payment by the Executing Agency under its responsibility by keeping budget in DPP/TAPP.

16-4. Proper Operation and maintenance

To maintain and use properly and effectively equipment provided under the Grant Aid, the Bangladesh side agreed the necessary obligations as follows:

1) Allocation of operation and maintenance cost

*Tentative estimates for 10 years are described in Annex 5.

2) Operation and maintenance structure

3) Routine check/Periodic inspection

JICA agreed that consumables and replacement parts except calibration gases shall be included in the Project for the period of three years from the beginning of the operation. The calibration gases shall be provided for the period of two years.

16-5. Security measures

Both sides confirmed that the Executing Agency shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities during the Project period. Such security measures shall reasonably reflect needs of the Consultant/the Contractor engaging in the Project.

17. Environmental and Social Considerations

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010/January 2022)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as C because the Project is likely to have minimal adverse impact on the environment under the Guidelines.

18. Other Relevant Issues

18-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which project cost is excluded will be disclosed to the public after completion of the Preparatory Survey. The comprehensive report including the project cost will be disclosed to the public after all the contracts under the Project are concluded.

18-2. Gender Mainstreaming

Both sides confirmed that gender mainstreaming should be duly practiced for the Project implementation. In particular, both sides agreed on the following gender element to be integrated into the Project.

-Careful consideration on gender balance when selecting the trainees (For example, at a minimum, the percentage of female trainees is not less than that of the entire DoE officers.

Annex 1 Project Site

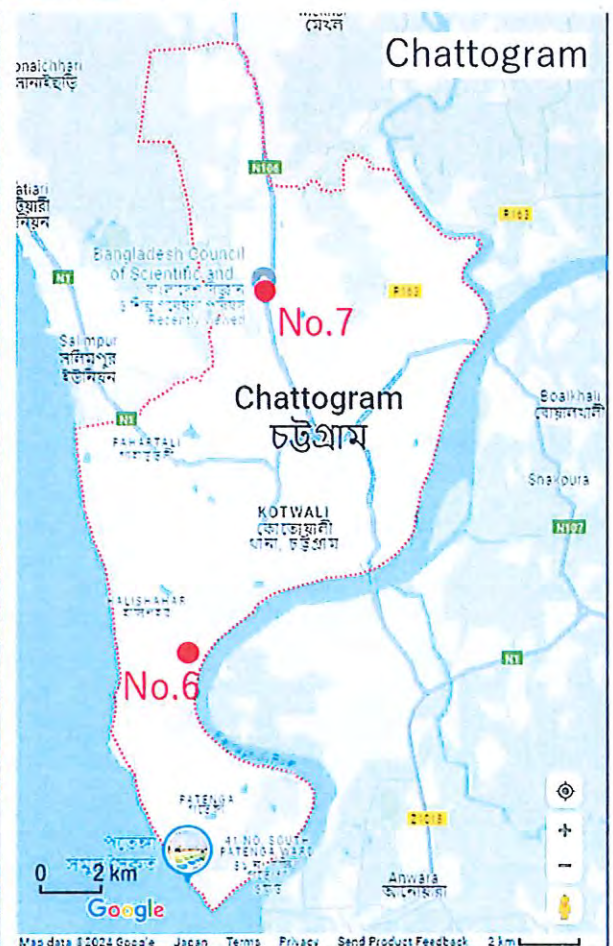
Annex 2 Organization Chart

Annex 3 Japanese Grant

Annex 4 Project Implementation Schedule

Annex 5 Major Undertakings to be taken by the Government of Bangladesh

Annex 6 Project Monitoring Report (template)



Prepared using Google Maps (© 2024 Google)

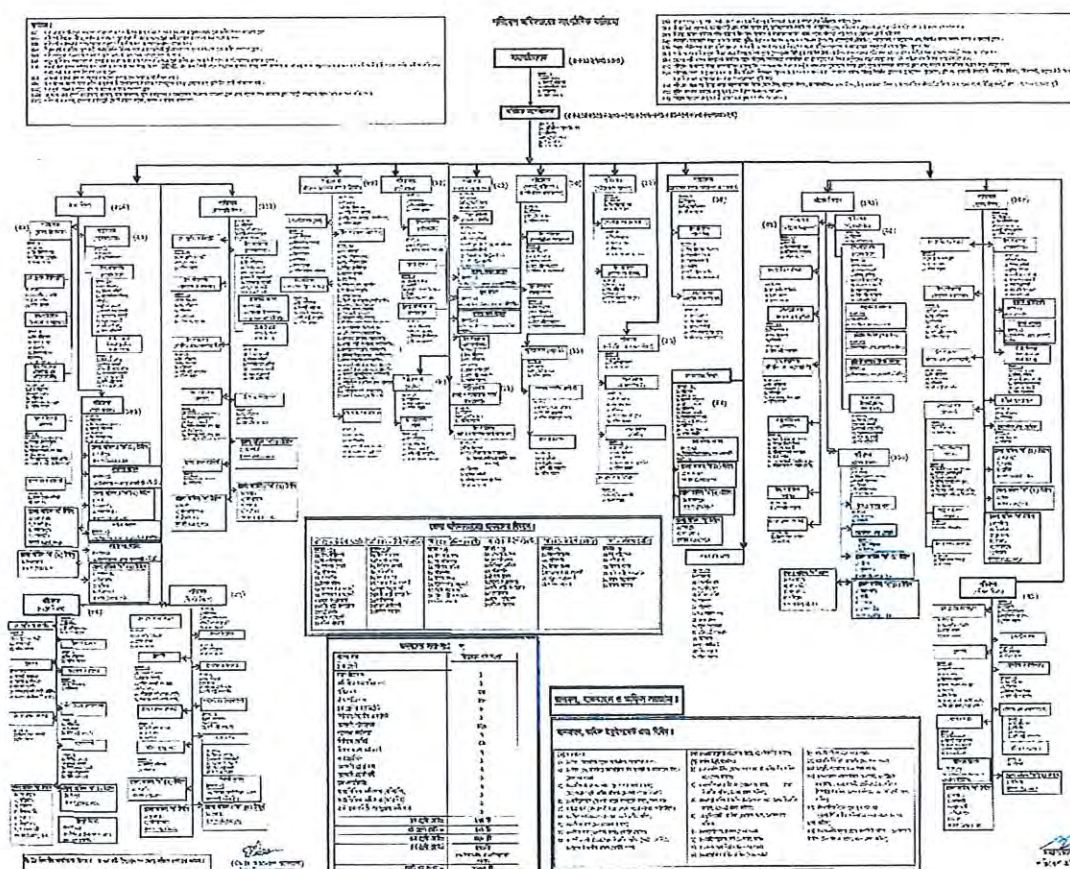
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Organization Chart

Department of Environment, Ministry of Environment, Forests and Climate Change



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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 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

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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

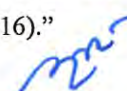
JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

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

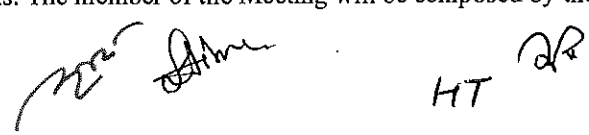
The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

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

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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) Measures to ensure more efficient implementation of the Grant

- i) In the event that the E/N and the G/A concerning a project cannot be signed by the end of the following Japanese fiscal year of the cabinet decision concerned by the GOJ, the authorities concerned of the two Governments will discuss the cancellation of the project.

ii) In the event that the period, specified in the G/A, during which the grant is available expires before the completion of the disbursement, the authorities concerned of the GO J will thoroughly review the status, situation and perspective of the implementation of the project concerned before extending the said period. The authorities concerned of the two Governments will discuss the termination of the project including a refund, unless there are concrete prospects for its completion.

iii) Regardless of the period mentioned in ii) above, the authorities concerned of the two Governments will, in the event that five years have passed since the cabinet decision concerned by the GOJ before the completion of the disbursement, except as otherwise confirmed between them, discuss the termination of a project including a refund, unless there are concrete prospects for its completion.

4) 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.

5) 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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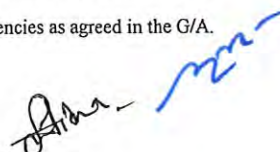
PROCEDURES OF JAPANESE GRANT

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate.		x		x	x		
2. Appraisal	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

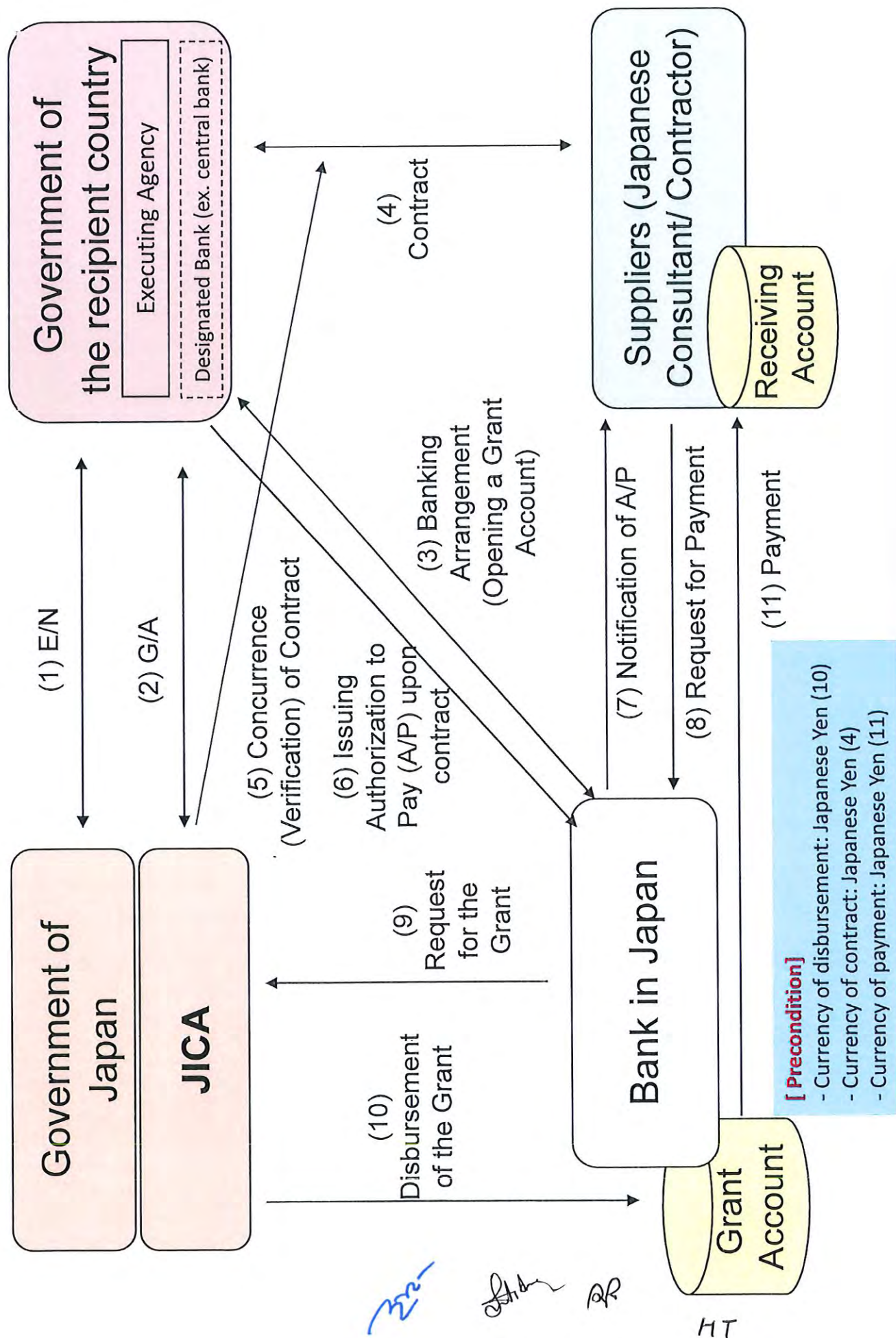
notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

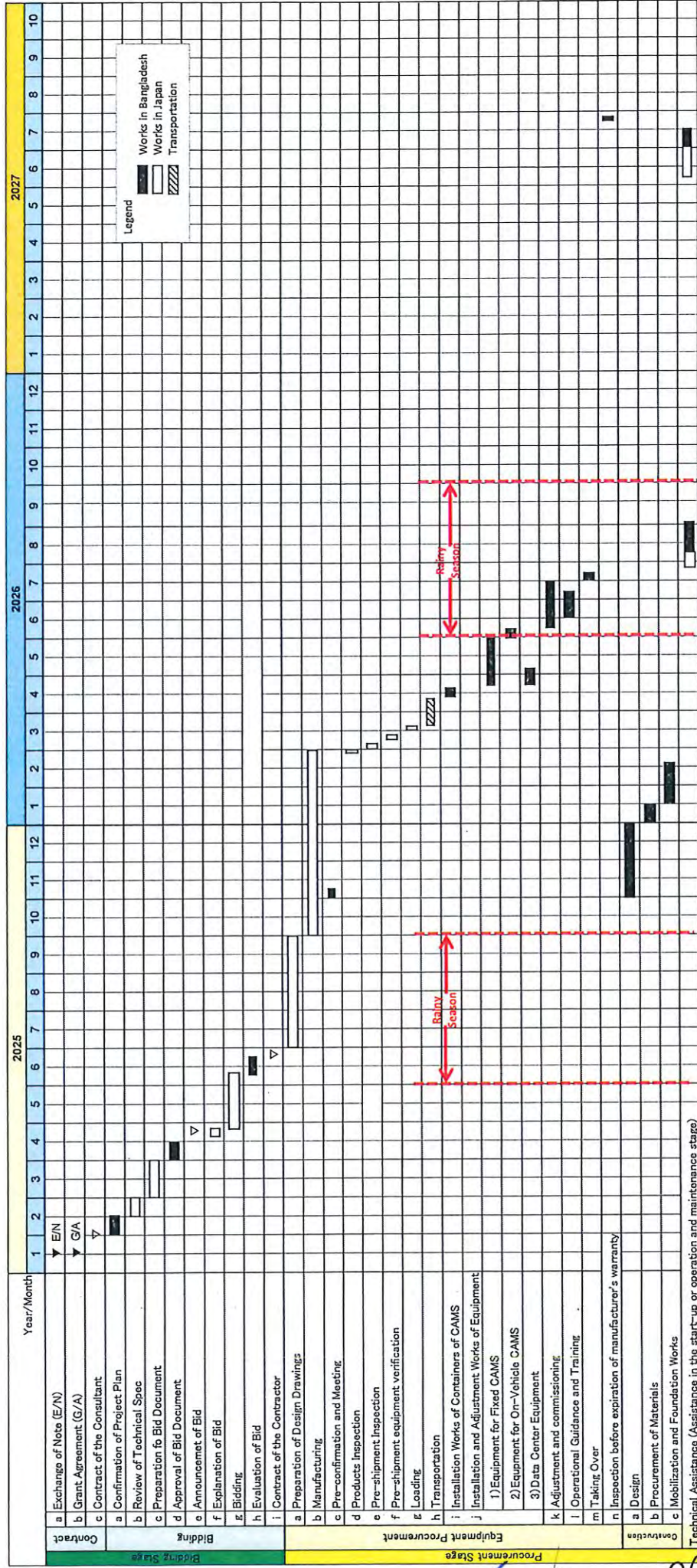



Financial Flow of Japanese Grant (A/P Type)



Project Implementation Schedule

Annex 4



Major Undertakings to be taken by the Government of Bangladesh

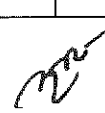
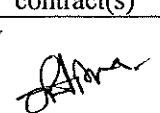
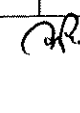
1. Specific obligations of the Government of Bangladesh which will not be funded with the Grant**(1) Before the Tender**

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	Development Project Proposal (DPP) for the project to be prepared by DoE and to submit to the Competent Authorities for approval according to the necessary procedures of the Government of Bangladesh		MoEFCC DoE		
2	To obtain written approval from each landowning agency for the use of the land for the seven project sites.	before the signing of the G/A	MoEFCC DoE		
3	To obtain signed Memorandum of Understanding (MOU) with each land-owning agency.	at the earliest opportunity	MoEFCC DoE		
4	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	MoEFCC DoE		
5	To issue A/P to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	MoEFCC DoE		
6	To bear the following commissions to the Agent Bank for the banking services based upon B/A				
	1) Advising commission of A/P for the consultant	within 1 month after the signing of the contract(s)	MoEFCC DoE		
	2) Payment commission for A/P for the consultant	every payment	MoEFCC DoE		
7	To submit Project Monitoring Report (with the result of Detailed Design) in corporation with the consultant	before preparation of the bidding documents	DoE		
8	To obtain the planning, zoning, building permit such as construction approval by landowner, tree cutting permit (if necessary).	before notice of the bidding documents	DoE		
9	To clear, level and reclaim the project sites	before notice of the bidding documents	DoE		
10	To secure a storage site for the on-vehicle CAMS	before notice of the bidding documents	DoE		
11	To secure a warehouse with air-conditioners for storing spare parts and consumable parts of equipment.	before notice of the bidding documents	DoE		

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(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to the Agent Bank for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	MoEFCC DoE		
2	To bear the following commissions to the Agent Bank for the banking services based upon the B/A				
	1) Advising commission of A/P for the Supplier(s)	within 1 month after the signing of the contract(s)	MoEFCC DoE	Included in *1	
	2) Payment commission for A/P for the Supplier(s)	every payment	MoEFCC DoE		
3	To ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	DoE		
4	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	DoE		
5	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 borne by its designated authority without using the Grant	during the Project	MoEFCC DoE		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	MoEFCC DoE		
7	To ensure the safety of persons engaged in the implementation of the Project	during the Project	DoE		
8	To ensure transport for the personnel and to shoulder the dispatching cost of the trainees to the training sites, such as daily allowance, accommodation, etc.	during the Project	MoEFCC DoE		
9	To provide facilities for drainage and other incidental facilities necessary for the implementation of the Project outside the sites	before the installation	DoE		
10	To provide facilities for distribution of electricity and the distributing line to the site for power source of fixed and on-vehicle CAMS.	before the installation	DoE	Approx. 2 million BDT	
11	To subscribe mobile communication services for on-vehicle CAMS and landline (optical fiber) communication services for CAMS including connecting works to CAMS.	during and after the installation	DoE		
12	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the installation	DoE		
13	1) To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training in corporation with the consultant	within 1 month after completion of each work	DoE		
	2) To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.) in corporation with the consultant	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	DoE		

Handwritten signatures and initials:
  

HT

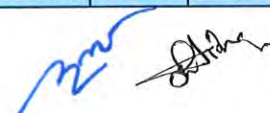
NO	Items	Deadline	In charge	Estimated Cost	Ref.
14	To submit a notice concerning completion of the Project	within 6 months after completion of the Project	DoE		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To maintain and use properly and effectively equipment provided under the Grant Aid 1) Allocation of operation and maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the installation	MoEFCC DoE	As the following chart	

*Tentative estimates of operation and maintenance cost for 10 years

Item	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
Roadside CAMSs and ancillary equipment	173,433	107,250	113,148	119,372	125,937	1,360,138	4,652,194	18,505,120	156,014	164,595
Data Center Equipment	0	0	0	0	0	144,447	0	1,848,894	16,294,655	0
Consumables and replacement parts for analyzers	0	0	5,787,675	11,654,679	16,256,704	20,325,001	18,549,274	12,615,400	20,475,501	14,860,986
Costs for outsourcing companies	6,458,556	6,813,777	7,188,534	7,583,904	8,001,018	8,441,074	8,905,334	9,395,127	9,911,859	10,457,011
Periodic inspections by a manufacturer or a distributor of analyzers	0	6,658,378	6,791,545	6,927,376	7,065,924	8,119,660	7,351,387	7,498,415	7,648,383	7,801,351
Emergency inspections and overhauls	0	As needed								
Total (BDT)	6,631,989	13,579,404	19,880,903	26,285,331	31,449,583	38,390,320	39,458,189	49,862,956	54,486,412	33,283,943




2. Other obligations of the Government of Bangladesh funded with the Grant

NO	Items	Deadline	Amount (Million Japanese Yen)*
1	To provide equipment 1) To conduct the following transportation a) Marine (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, procurement supervision and soft component (Consulting Service)		
	Total		

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



This page is closed due to confidentiality

<u>Project Monitoring Report</u> on <u>Project Name</u> <u>Grant Agreement No. XXXXXXXX</u> 20XX, Month
--

Organizational Information

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

General Information:

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

[Signature]

[Signature]

[Signature]

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)

2-3 Implementation Schedule

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

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 (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	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 (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
	1.			

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.

Original (at the time of outline design)

name:

role:

financial situation:

institutional and organizational arrangement (organogram):

human resources (number and ability of staff):

Actual (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.)

Original (at the time of outline design)

Actual (PMR)

3-2 Budgetary Arrangement

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

Original (at the time of outline design)

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:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures (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.

--

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. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final) only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)
12. Report on the Management of Safety for Construction Works



Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C-D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st month, 2015	2nd month, 2015	3rd month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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%)	





Report on the Management of Safety for Construction Works

Month/Year 2022 年 × 月	Cumulative number of labor 労働延人数	Cumulative number of public accident 公衆災害件数	Cumulative hours worked 延べ実労働時 間数	Number of deaths and injuries due to industrial accidents 労働災害による死傷者				Frequency rate 度数率	Severity rate 強度率
				Death and injuries 死傷者数	Aggregated number of calendar days absent 延べ休業日数	Aggregated number of work- days lost 延べ労働損失日数			
This Month 当月				Death 死者					
				More than 4 calendar days absent 休業 4 日以上					
				1 to 3 calendar days absent 休業 1～3 日					
				Total 計					
Total including this month 当月迄累計				Death 死者					
				More than 4 calendar days absent 休業 4 日以上					
				1 to 3 calendar days absent 休業 1～3 日					
				Total 計					
Note 注) 1. Frequency rate is the frequency of occurrence of industrial accidents. $\text{Frequency rate} = (\text{Number of deaths and injuries due to industrial accidents} \div \text{Cumulative hours worked}) \times 1,000,000$ 度数率 = (労働災害による死傷者数 ÷ 延べ実労働時間数) × 100 万時間 2. Severity rate is degree of seriousness of the industrial accident. $\text{Severity rate} = (\text{Aggregated number of work-days lost} \div \text{Cumulative hours worked}) \times 1,000$ 強度率 = (延べ労働損失日数 ÷ 延べ実労働時間数) 1000 時間 3. Aggregated number of work-days lost = Aggregated number of calendar days absent × (300 ÷ 365) Death (7,500 days) : death as a result of an industrial accident includes not only instantaneous death but also death as a result of occupational injury or disease. 延べ労働損失日数 = 延べ休業日数 × (300 ÷ 365) . . . 死亡 7500 日 (即死のほか負傷が原因で死亡したものを含む) 4. Frequency rate and severity rate are rounding off the third decimal place. 度数率・強度率は小数点第 3 位以下四捨五入									

Appendix-5

Soft Component (Technical Assistance) Plan

Japan International Cooperation Agency

THE PREPARATORY SURVEY
FOR
THE PROJECT FOR THE IMPROVEMENT OF
EQUIPMENT FOR
AIR POLLUTION MONITORING
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

Soft Component (Technical
Assistance) Plan

November 2024

Joint Venture of the Preparatory Survey for the
Project for the Improvement of Equipment of Air
Pollution Monitoring

Table of Contents

1.	Background	1
2	Objectives	1
3	Outputs	1
4	Means of verification of achievement of the outputs	1
5	Activities of the soft component (Input plan)	3
6	Methods for procurement of resources for soft components.....	4
7	Schedule.....	5
8	Deliverables.....	6
9	Responsibilities of the Bangladesh side	6

1. Background

The following equipment will be provided by the “the Project for the Improvement of Equipment for Air Pollution Monitoring” (hereinafter referred to as “the project”).

- Roadside CAMS: Fixed CAMS: 7, On-vehicle CAMS: 1
- Data Center Equipment (workstation, etc.)

A contractor of the project will provide an operation guidance for the above equipment at the installation stage. However, it is quite a challenge for DoE to properly implement the operation and maintenance (O&M) of the equipment and to analyze the data obtained from the roadside CAMSs with the guidance. Therefore, the project will provide technical assistance to DoE as a soft component of the project.

2 Objectives

The objectives are set as follows:

- DoE officials operate and maintain the roadside CAMSs and obtain air quality measurement results continuously.
- DoE officials evaluate the ambient air quality based on data obtained from the roadside CAMSs

3 Outputs

The outputs are set as follows:

- Output 1: Development of the plan for preventive inspection and O&M CAMS
- Output 2: Enhancement of the capability on accuracy control and analysis of monitoring data.

Achievement of the above results will enable sustainable and accurate monitoring of roadside air pollution.

4 Means of verification of achievement of the outputs

Table-1 shows the items and means to be used to verify the achievement of the outputs.

Table-1 Items and means to be used to verify the achievement for each output

Output	Items to verify the achievement	Means of verification
Output 1: Development of the plan for preventive inspection and O&M	1. Necessary budget and implementation system are clarified by developing the budget/staffing plan of preventive inspection and O&M. 2. Preventive maintenance of the roadside CAMSs is implemented and the results are reported and stored based on the developed procedure manual on the preventive inspection and O&M. 3. Each equipment is adequately inspected using checklists, etc. using the developed procedure manual on equipment management. A system for accumulating the results of troubleshooting will be developed.	Confirm the status of activities by DoE and by questionnaire for the items listed on the left.
Output 2: Enhancement of the capability on accuracy control and analysis of monitoring data.	1. Abnormal values of monitoring results of air quality and meteorology obtained by the roadside CAMSs are identified and eliminated based on the developed procedure manual on data screening. 2. Analysis of time series data and relationships between measurement items and determination of the status of compliance with environmental standards will be conducted based on the manual on data processing.	

5 Activities of the soft component (Input plan)

Table 2 shows the input plan of the soft component. An implementation timeline for each item is shown in Chapter 7.

Table-2 Input plan for soft component

Output	Trainer	Required level of technique	Training materials	Implementation plan	Input*
Output 1: Development of the plan for preventive inspection and O&M	Experts with skills in CAMS O&M and inspection	Capable of securing the necessary budget and implementation system for CAMS O&M and inspection.	Budget/staffing plan, preventive inspection and O&M procedure, equipment management procedure, etc.	- Training on budget and staffing planning for preventive inspection and O&M (3 days) - Training on preventive inspection and O&M (2 days in Dhaka, 2 days in Chattogram) - Training of equipment management procedure (4 days in Dhaka, 3 days in Chattogram)	Expert on CAMS O&M : -In Japan: 10 days -In Bangladesh: 14 days (in total 20 days)
Output 2: Enhancement of the capability on accuracy control and analysis of monitoring data.	Experts with skills in analyzing air quality and meteorological data	Capable of judging abnormal values and processing data.	Screening procedure, processing procedure, etc.	1st: - On-site confirmation of data acquisition by Japanese expert (3 days), and training on data collection (2 days in Dhaka) 2nd: - Training on data screening to judge/remove abnormal values (3 days in Dhaka) - Training on data processing (4 days in Dhaka) - Training on data analysis (4 days in Dhaka)	Expert on air quality data analysis : 1 st : -Bangladesh: 5 days (7 days) 2 nd : -Japan: 18 days -Bangladesh: 11 days (in total 17 days)

* Numbers in brackets include holidays and travel days.

Table-3 shows the expected number of trainees. It is not intended to preclude the participation of more participants than indicated here. Currently, there are 31 officers in charge of CAMS O&M in DoE, including 7 female officers. It is requested that DoE consider gender balance in this project and ensure that the same or higher percentage of female officers participate in the training.

Table-3 Number of trainees

Organization	Training	Number *		Output
		Leader	Officer	
DoE AQMW	budget/staffing planning	1	1	Output 1
	CAMS O&M and equipment management	1	2	Output 1
	Data Analysis	1	2	Output 2
DoE Chattogram Laboratory	CAMS O&M and equipment management	1	2	Output 1

* Numbers in brackets include holidays and travel days.

6 Methods for procurement of resources for soft components

The following reasons make it appropriate for Japanese experts to conduct the training in the soft component

- Technical skills to handle Japanese equipment and knowledge to provide guidance are needed.
- Currently, the DoE has a local consultant to prepare air quality reports, but is having difficulty in preparing them in a timely manner.

7 Schedule

The training will start after the installation of the roadside CAMSs and end in one year. Output 1 will start shortly after handover from the contractor. Output 2 will be implemented on two occasions: one is just after the completion of the output 1, and the other is at the end of the period when the various monitoring data have been accumulated including the dry and rainy seasons.

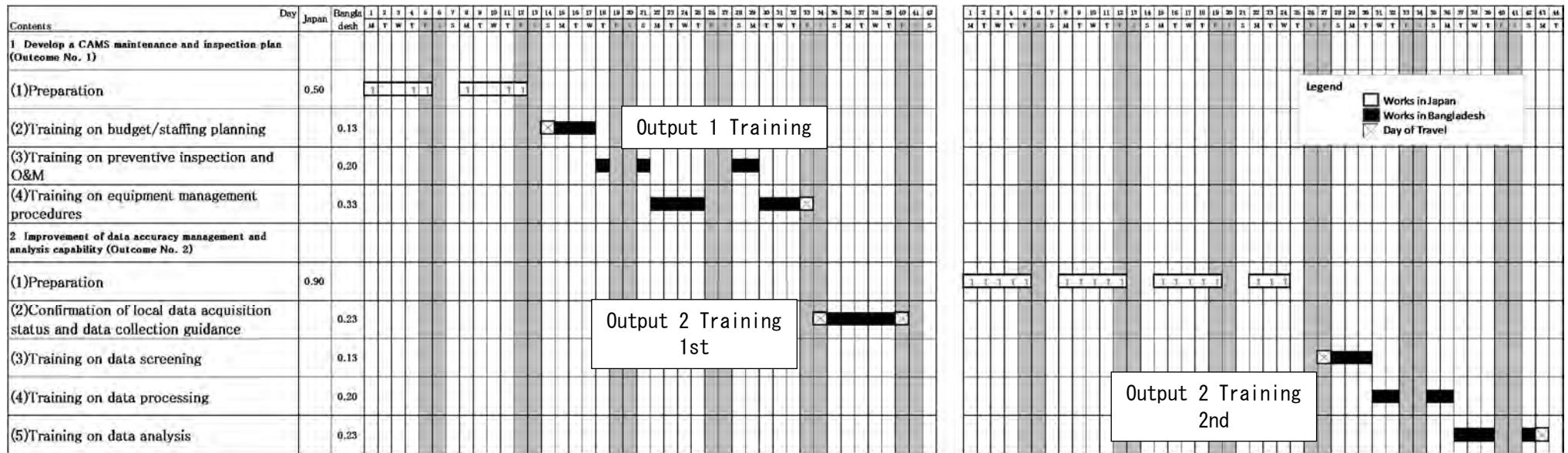


Figure-1 Schedule

8 Deliverables

- A) Budget and staffing plan
- B) Preventive maintenance and O&M procedure¹
- C) Equipment management procedure²
- D) Data screening procedure
- E) Data processing procedure
- F) Data analysis procedure
- G) Questionnaire survey results (results of achievement check)
- H) Photos of training activity
- I) Completion report to JICA

- 1: Procedures defining the recording, reporting, and storage of results related to the preventive inspection and O&M of the CAMS.
- 2: O&M planning chart, record book for O&M, management ledgers for roadside CAMS, analyzers, calibration gases, etc.

9 Responsibilities of the Bangladesh side

Continuous efforts by DoE to operate and maintain CAMS will be essential to achieving the goals of the project.

DoE will develop an implementation system based on the budget and staffing plan that will be developed during the soft component training. Steady efforts will be made to operate and maintain CAMS based on various procedures and checklists. In addition, the DoE will accumulate records of troubleshooting to enhance its application capabilities. In addition, technology should be passed on within DoE.

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Appendix-6

Outline Design Drawings

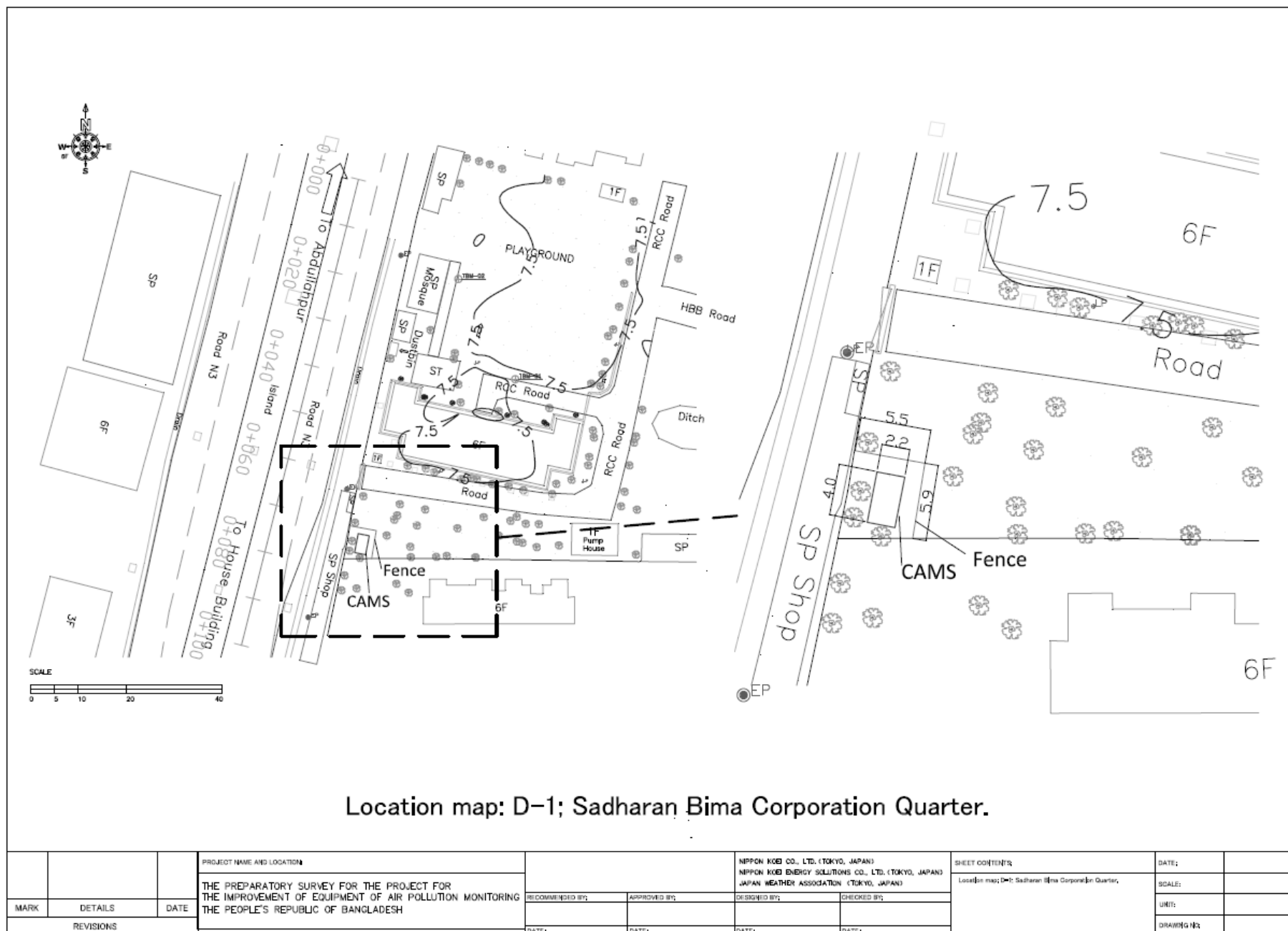
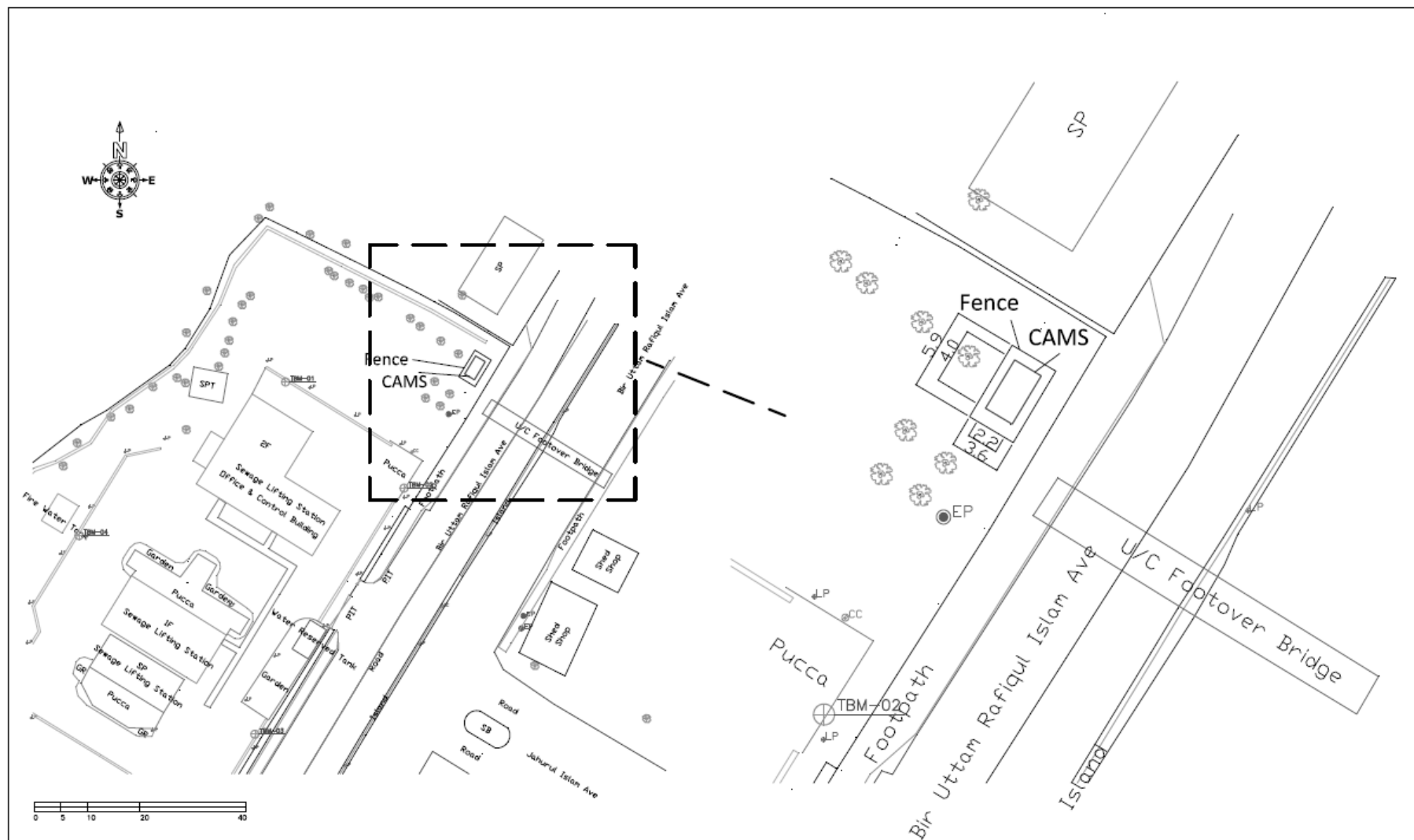


Figure 1 Installation Position of Roadside CAMS (Dhaka, Sadharan Bima Corporation)



Location map: D-2; Hatirjheel Sewage Treatment Plant.

			PROJECT NAME AND LOCATION		NIPPON KOB CO., LTD. (TOKYO, JAPAN) NIPPON KOB ENERGY SOLUTIONS CO., LTD. (TOKYO, JAPAN) JAPAN WEATHER ASSOCIATION (TOKYO, JAPAN)		SHEET CONTENTS	DATE:	
MARK	DETAILS	DATE	THE PREPARATORY SURVEY FOR THE PROJECT FOR THE IMPROVEMENT OF EQUIPMENT OF AIR POLLUTION MONITORING THE PEOPLE'S REPUBLIC OF BANGLADESH		RECOMMENDED BY:	APPROVED BY:	DESIGNED BY:	Location map: D-2; Hatirjheel Sewage Treatment Plant.	SCALE:
REVISIONS					DATE:	DATE:	CHECKED BY:		UNIT:
					DATE:	DATE:	DATE:		DRAWING NO:

Figure 2 Installation Position of Roadside CAMS (Dhaka, DWASA)

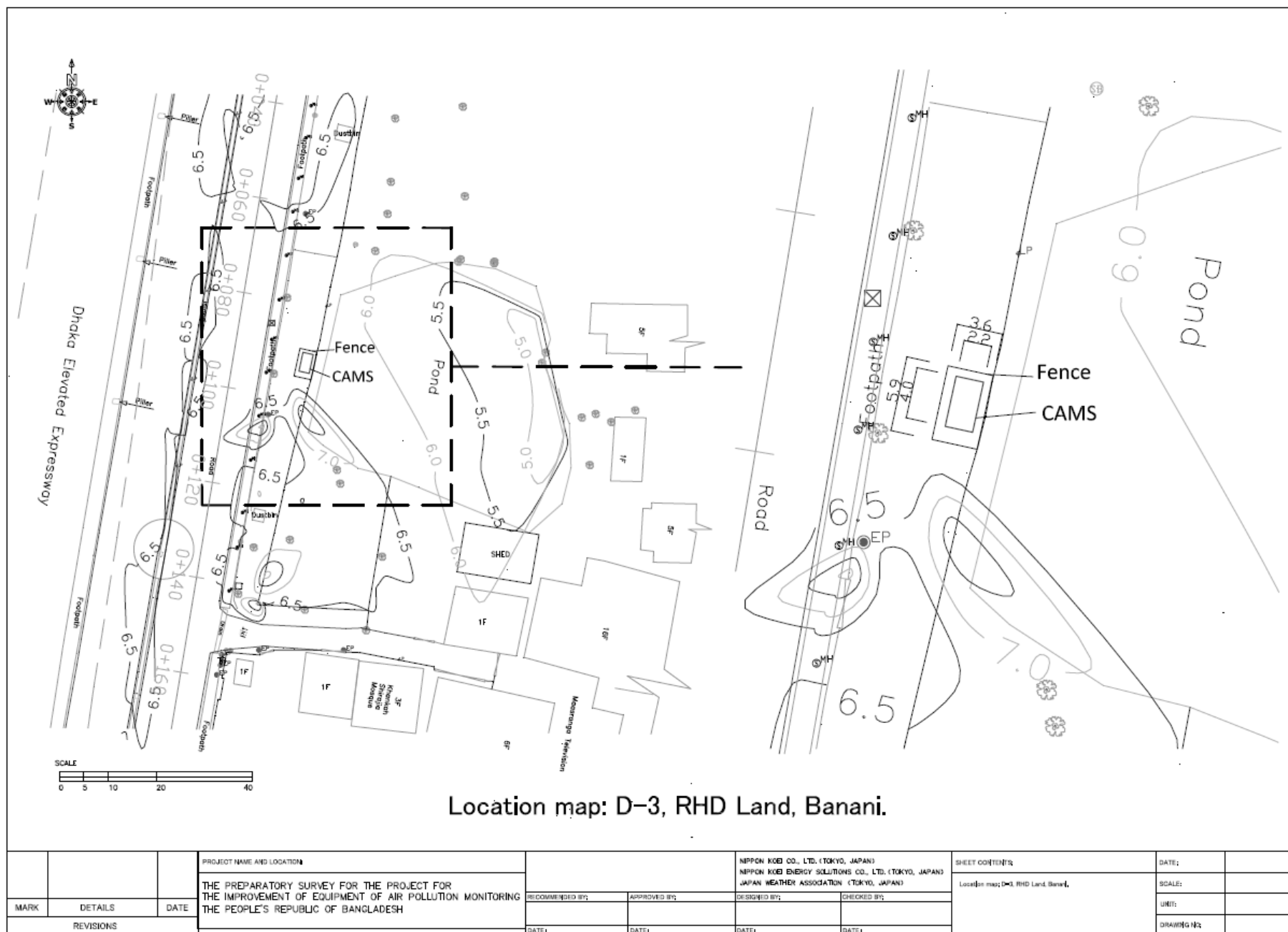
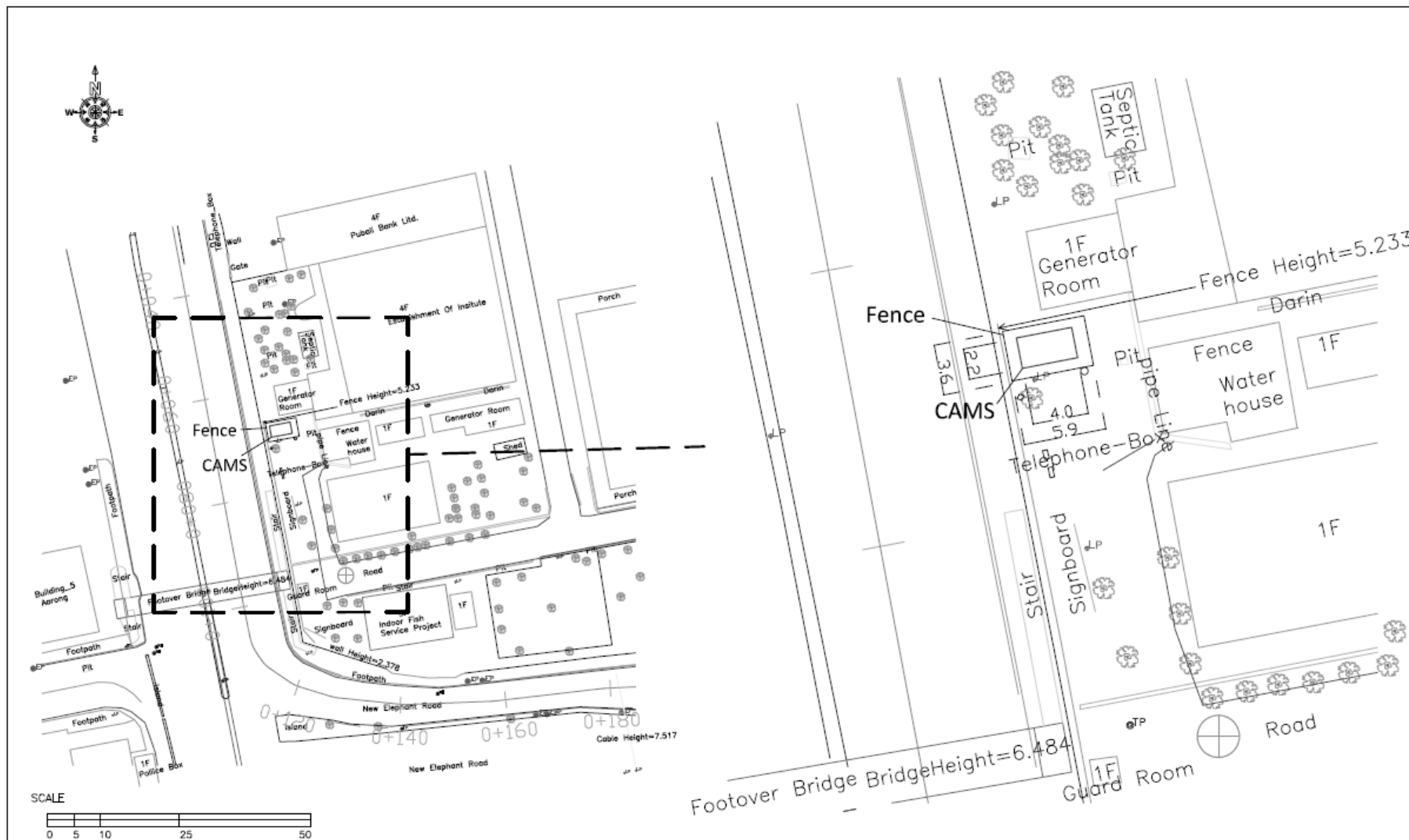


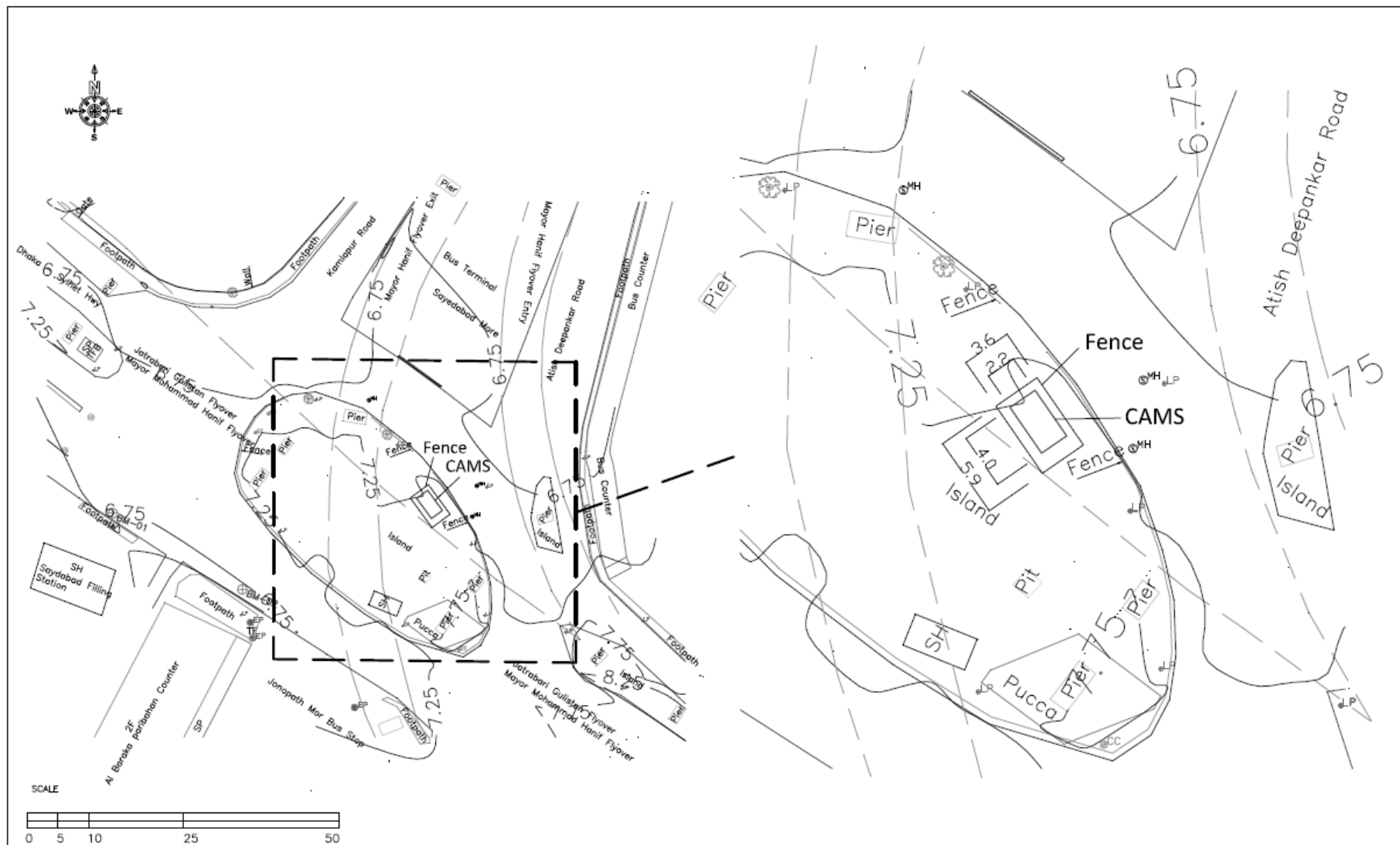
Figure 3 Installation Position of Roadside CAMS (Dhaka, RHD)



Location map: D-9, BCSIR, DHAKA.

			PROJECT NAME AND LOCATION		NIPPON KOEI CO., LTD. (TOKYO, JAPAN) NIPPON KOEI ENERGY SOLUTIONS CO., LTD. (TOKYO, JAPAN) JAPAN WEATHER ASSOCIATION (TOKYO, JAPAN)				SHEET CONTENTS	DATE:	
			THE PREPARATORY SURVEY FOR THE PROJECT FOR THE IMPROVEMENT OF EQUIPMENT OF AIR POLLUTION MONITORING THE PEOPLE'S REPUBLIC OF BANGLADESH		RECOMMENDED BY:	APPROVED BY:	DESIGNED BY:	CHECKED BY:	Location map D-9, BCSIR, DHAKA,	SCALE:	
MARK	DETAILS	DATE								UNIT:	
REVISIONS					DATE:	DATE:	DATE:	DATE:		DRAWING NO:	
									</		

Figure 4 Installation Position of Roadside CAMS (Dhaka, BCSIR)



Location map: D-10; DSCC Land, Saydabad Bus Terminal, Dhaka.

			PROJECT NAME AND LOCATION		NIPPON KOB CO., LTD. (TOKYO, JAPAN) NIPPON KOB ENERGY SOLUTIONS CO., LTD. (TOKYO, JAPAN) JAPAN WEATHER ASSOCIATION (TOKYO, JAPAN)		SHEET CONTENTS		DATE:		
			THE PREPARATORY SURVEY FOR THE PROJECT FOR THE IMPROVEMENT OF EQUIPMENT OF AIR POLLUTION MONITORING THE PEOPLE'S REPUBLIC OF BANGLADESH		RECOMMENDED BY:		Location map: D-10; DSCC Land, Saydabad Bus Terminal, Dhaka.		SCALE:		
MARK	DETAILS	DATE			APPROVED BY:		DESIGNED BY:		UNIT:		
REVISIONS					DATE:		DATE:		DATE:		DRAWING NO:

Figure 5 Installation Position of Roadside CAMS (Dhaka, DSCC)

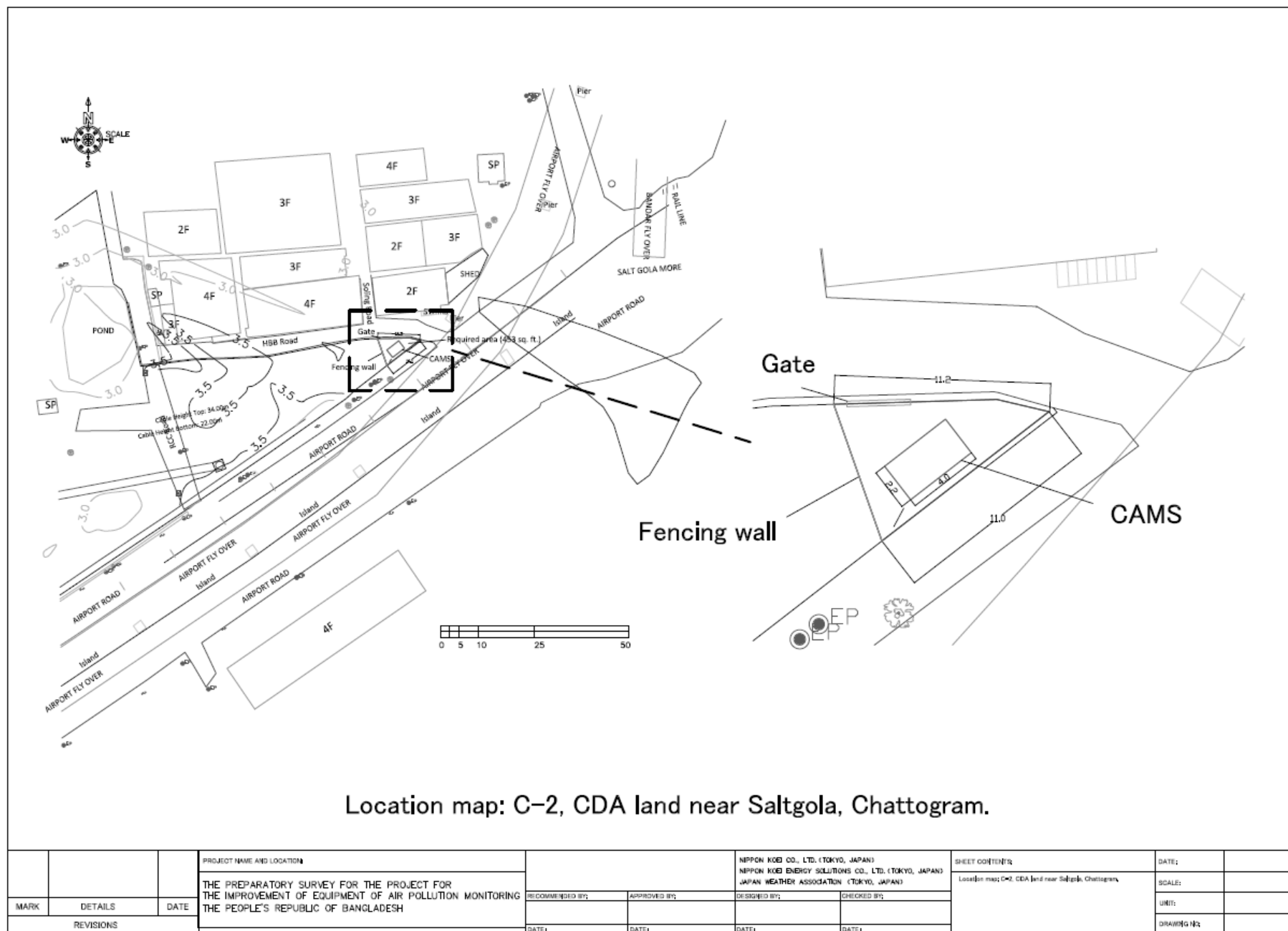


Figure 6 Installation Position of Roadside CAMS (Chattogram, CDA)

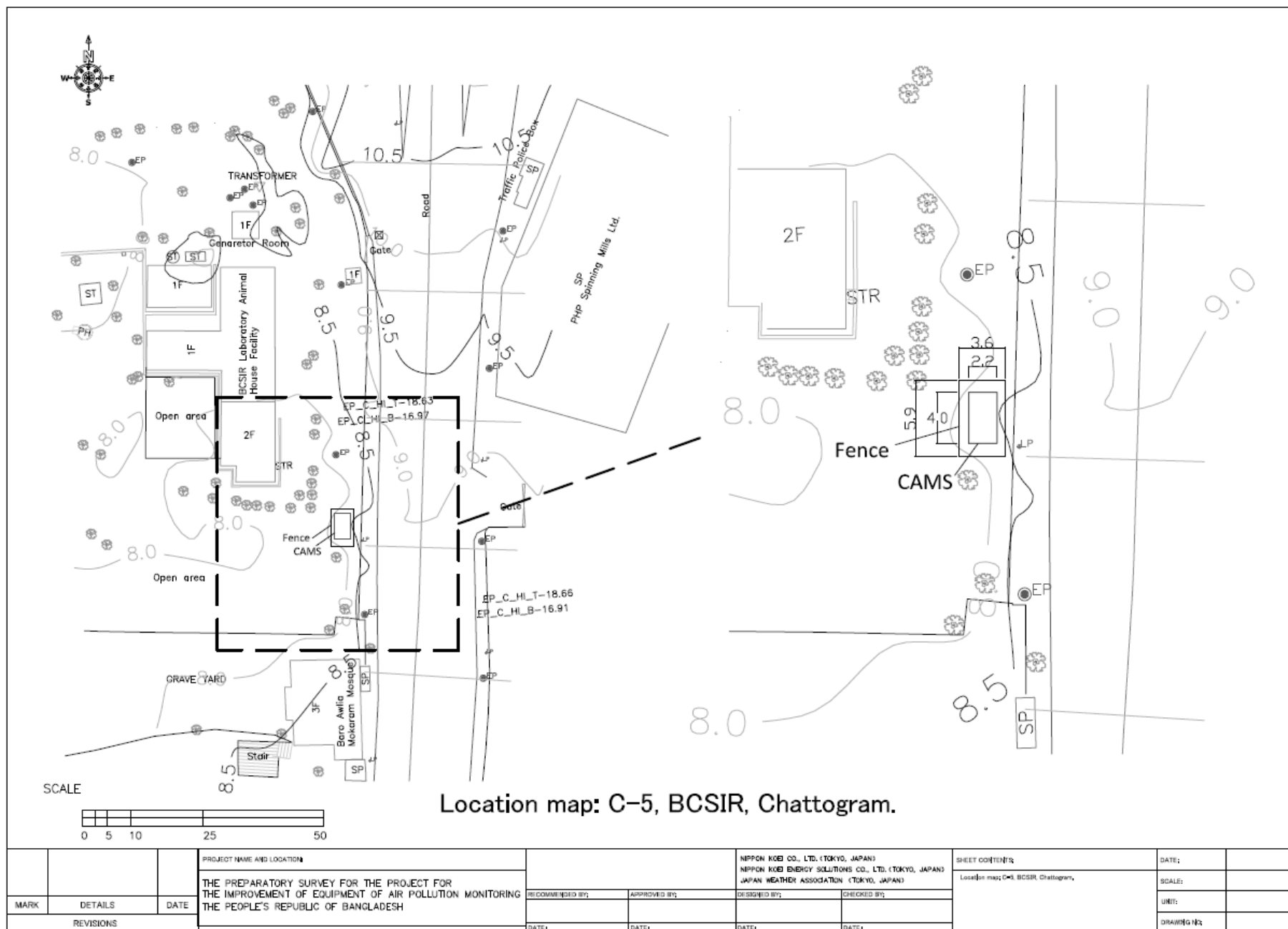


Figure 7 Installation Position of Roadside CAMS (Chattogram, BCSIR)