MINISTRY OF ROADS AND HIGHWAYS
GHANA HIGHWAY AUTHORITY

PREPARATORY SURVEY
ON
THE PROJECT FOR THE IMPROVEMENT
OF
THE TEMA MOTORWAY ROUNDABOUT
[Phase-2]

FINAL REPORT

February 2020

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
CTI ENGINEERING INTERNATIONAL CO., LTD.

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PREFACE

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

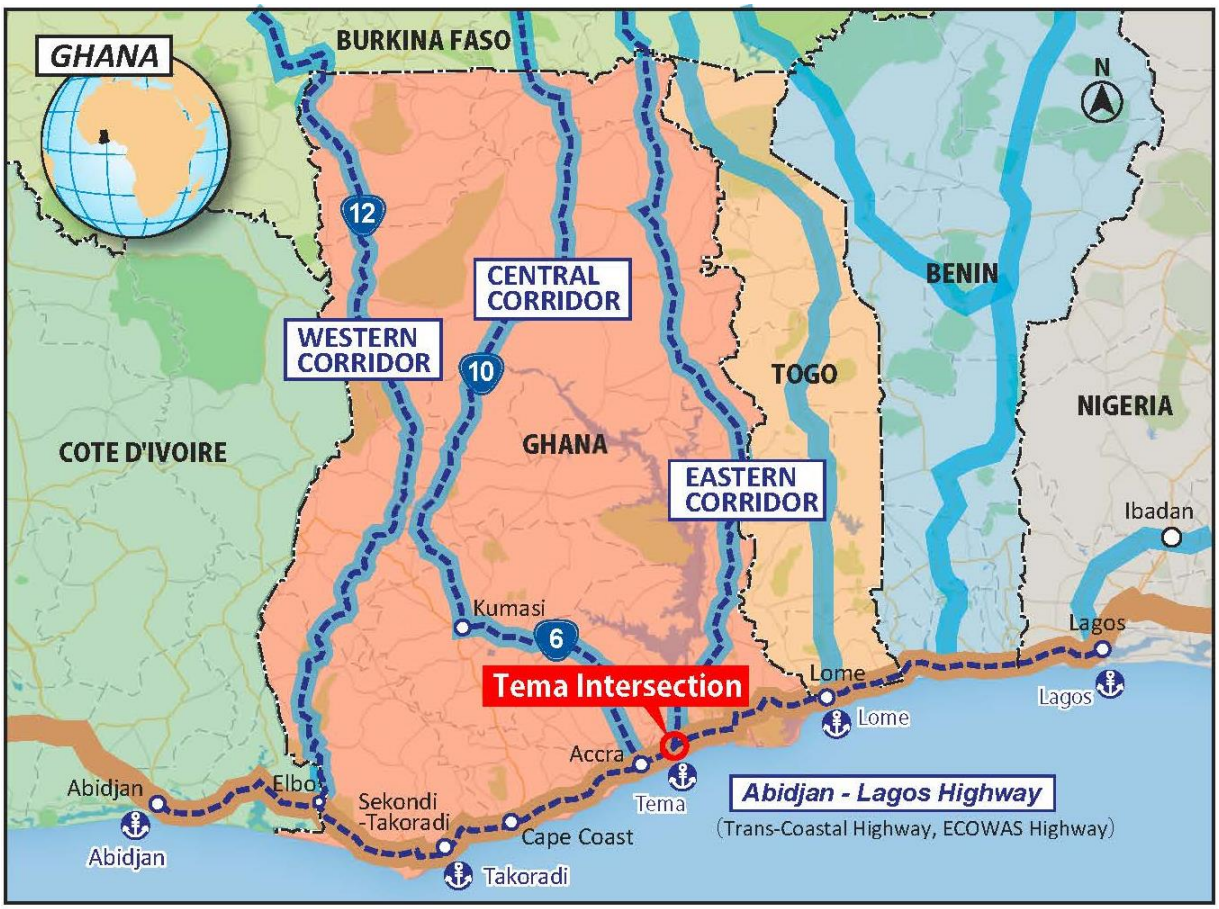
The survey team held a series of discussions with the officials concerned of the Government of the Republic of Ghana, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

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

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

February 2020

Itsu ADACHI
Director General
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency



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PERSPECTIVE

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ABBREVIATIONS

AASHTO	:	American Association of State Highway Transportation Officials
ASTM		American Society for Testing and Materials
CBR	:	Carifornia Bearing Ratio
D/D	:	Detailed Design
DFR	:	Department of Feeder Roads
DHV	:	Design Hourly Volume
DUR	:	Department of Urban Roads
ECOWAS	:	Economic Community of West African States
E/N	:	Exchange of Notes
EIA	:	Environmental Impact Assessment
EPA	:	Environmental Protection Agency
GHA	:	Ghana Highway Authority
GRA	:	Greater Accra Region
GPHA	:	Ghana Ports and Harbour Authority
GOG	:	Government of Ghana
GOJ	:	Government of Japan
IC/R	:	Inception Report
IEE	:	Initial Environmental Examination
IT/R	:	Interim Report
JICA	:	Japan International Cooperation Agency
JIS	:	Japanese Industrial Standard
LOS	:	Level of Service
MOF	:	Ministry of Finance
MRH	:	Ministry of Roads & Highway
NTP	:	National Transport Policy
O/D	:	Outline Design
ODA	:	Official Development Assistance
PPP	:	Public Private Partnership
R/D	:	Record of Discussion
ROW	:	Right of Way
RSDP	:	Road Sector Development Programme
TDC	:	Tema Development Corporation
T/R	:	Technical Review

1. Background of the Project

1.1 Background and Outline of the Project

The Republic of Ghana (hereinafter "Ghana") has been making remarkable progress recently in expanding international trunk roads to facilitate both the international and the domestic transportation. Currently, road traffic in the country accounts for about 95% of the total transportation volume of roads, railways, water transportation, and airports. The need for expansion and stretching of the road network to cater for the increasing trade volume resulting from the recent rapid economic growth of the country is high and growing. Greater Accra Region, where the capital city Accra and the port city of Tema are is highly concentrated with traffic as the Region is not only home to over 16.3% of the country's total population but also has high percentage of registered vehicles that accounts to 65% of the total vehicles while it occupies only 1.4% of the country's total land area.

The Tema Motorway Roundabout connects two international arterial roads, the Lagos-Abidjan Corridor, which is a part of the Dakar to Lagos Trans African Highway (TAH) No.7 of the Economic Community of Western African States (ECOWAS), and the Eastern Corridor of Ghana, which links Tema Port to the landlocked countries of Burkina Faso, Mali and Niger. Tema Roundabout is a 5-leg roundabout where traffic inflow to and from Accra and Tema Port converge causing traffic congestions and serving as a bottleneck for long-distance logistics. Usually during rush hours that is at the peak of morning and evening the roundabout is heavily congested with vehicles cueing for over a distance of 5 km from the intersection and running in a retarded speed lower than 10 km/h. The congestion and the decrease in speed at the roundabout is becoming an impediment to smooth and safe movement of people and traffic. This is compounded by the increase in traffic to and from Tema Port due to the increase in cargo handling volume at the port. The port has seen an increase of more than 60% in 10 years, from 2007 to 2016. The Government of Ghana (GOG) has plans to expand the Tema Port and put a bridge over Lake Volta under the ODA loan project "Eastern Corridor Volta River Bridge Project". Materialization of the port expansion and construction of the bridge will further attract traffic at Tema Roundabout contributing to significant rise of traffic volume in the region and at the roundabout as well. In order to enhance smooth and safe traffic flow (logistics) both within the country and the West African Region, urgent improvement of Tema Motorway Roundabout is inevitable.

The GOG formulated the National Transport Policy in 2008 and has been expanding and upgrading international corridors with an aim to achieve integrated, efficient, and sustainable transport system and further strengthen the function of the country with an aim to becoming the transport hub of the West African region. The Ministry of Roads and Highways (MRH) in its "Sector Medium -Term Development Plan: 2014-17" identifies improvement of Tema Intersection as one of the top priority projects for enhancing safe and smooth transportation at the intersection thereby contributing to enhancing the economic activities of the region including the entire country.

Under such circumstance, the GOG made a request to the Government of Japan (GOJ) for a grant aid assistance to improve the Tema intersection. In response to the request, JICA conducted "the Preparatory Survey on the Project for the Improvement of the Tema Motorway Roundabout" (hereafter "first Survey")

from April 2016 to February 2017, where grade separation of the roundabout was recommended to be implemented in two phases: Phase-1 recommended development of an underpass in the east-west direction and Phase-2 recommended putting a flyover/overpass in the north-south direction.

Exchange of Notes (E/N) was signed in April 2017 between the GOG and the GOJ for implementation of the "Ghanaian International Corridor Improvement Project" (hereinafter "Project under construction") for Phase-1 of the project. This was followed by signing of the Grant Agreement (G/A) between JICA and Ministry of Roads and Highways, Ghana Highway Authority (MRH/GHA). Based on these agreements, the detailed design, construction and construction supervision of the Phase-1 infrastructure was conducted. As of February 2020, construction of an underpass in the east-west direction (Motorway-Aflao) and an at-grade intersection are on-going. Completion of Phase-1 construction is scheduled in June 2020.

This report is prepared for Phase-2 (development of flyover/overpass along north-south direction), which compiles the results of the outline design drawing carried out reflecting the results of various engineering surveys undertaken in Ghana and information gathered from discussions and hearings conducted with the GHA and other relevant agencies of Ghana for assessment by JICA on the feasibility of the Phase-2 component request by GOG.

1.2 Requested Scope

The request made by the GOG for Phase-2 is to construct a flyover bridge over Tema Motorway Roundabout after completion of Phase-1 project, which is under construction at the same project site, including to develop the detailed design of the flyover and to carry out its construction supervision.

Phase-2 is the continuity of Phase-1. The requested scope by the GOG for Phase-1 was to construct an underpass, improve at-grade intersection, conduct the detailed design and supervise the construction. Phase-1 is at the construction stage, where the underpass (box-culvert) for through traffics in the east-west direction and an at-grade intersection for other traffics are currently under construction.

1.3 Objective of the Survey

The objectives of the Survey are to:

- Understand the background, purpose, and scope of project under the Grant Aid Assistance Scheme of Japan,
- Study the feasibility of the project in terms of effectiveness, technical and economic justification,
- Conduct outline design for minimum and optimal scope and scale of the project to achieve the outcome of the assistance,
- Estimate project cost, and
- Propose the contents, implementation and maintenance plan as well as critical points to be undertaken by the GOG in order to achieve the outcome and targets set for the project.

1.4 Outline of the Project

Targets, expected outcome, survey location and project beneficiaries are summarized in Table 1.4-1.

Table 1.4-1 Outline of the Project

1. Targets	Ultimate: Enhancement of transport efficiency and logistics in Greater Accra Region (GAR) Immediate: Improve traffic condition of traffics travelling along central Accra region and Tema Port
2. Expected Outcome	Flyover structure at the Tema intersection
3. Location	GAR, Tema City
4. Beneficiaries	Direct beneficiaries : Users of Tema Roundabout and people in the vicinity Indirect beneficiaries : 4 million people of GAR, Eastern International Corridor users

1.5 Study on Environmental and Social Considerations

In general, environmental and social considerations is conducted to evaluate the impacts from a development project to the environment and social conditions in and around the project area. The potential impacts to various parameters, such as fauna, flora, ambient air, ambient water and noise/vibration, resettlement, are studied through screening and scoping and mitigation measures suggested to be monitored and implemented accordingly before, during and after implementation of the project.

The project area of Phase-2 lies within the existing right-of-way (ROW) - to be precise in the middle of the existing ROW or within the Phase-1 area. Initial Environmental Examination (IEE) was conducted during Phase-1 which also covered the survey area of Phase-2. According to the Environmental Protection Agency (EPA), the responsible agency for environmental and social considerations, the environmental permit issued for Phase-1 is valid for Phase-2 also. This Survey therefore checked the permissibility of the existing environmental permit including necessity for conducting the Environmental and Social Considerations survey additionally and comparison of the impacts between Phase-1 and Phase-2.

1.5.1 Study on Initial Environment Examination

1.5.1.1 Project Components and the Category of Environmental and Social Consideration

The outline of the project components is as given below. The project components are to be implemented in two phases. Phase-2 project is categorized as class "B" by JICA.

Phase-2 Components
• Flyover (142 m) in the north-south direction (Harbour Road – Akosombo Road) 1.75 km • Signalled-controlled at-grade intersection • Ancillaries : (Traffic lights, Street lights, Drainage facilities, Safety facilities (crash barriers, road signs etc.))
Phase-1 Components
2-tier intersection (730 m underpass with 190 m long box-culvert in the east-west direction) (Motorway – Aflao Road) East-west: 2.1 km, north-south :1.9 km Ramps: approx. 7 km, Service roads: approx. 3.5 km Signalled-controlled at-grade intersection Ancillaries: (Traffic lights, Drainage facilities, 4 Pedestrian bridge , Safety facilities (crash barriers, road signs etc.)

As aforementioned, Phase-1 components are currently under construction. Figure 1.5-1 shows the major components of each phase. The blue line highlights the Phase-1 major component (a box-culvert in the east-west direction), and the red line highlights the Phase-2 major component (a flyover in the north-south direction over Tema Motorway Roundabout).

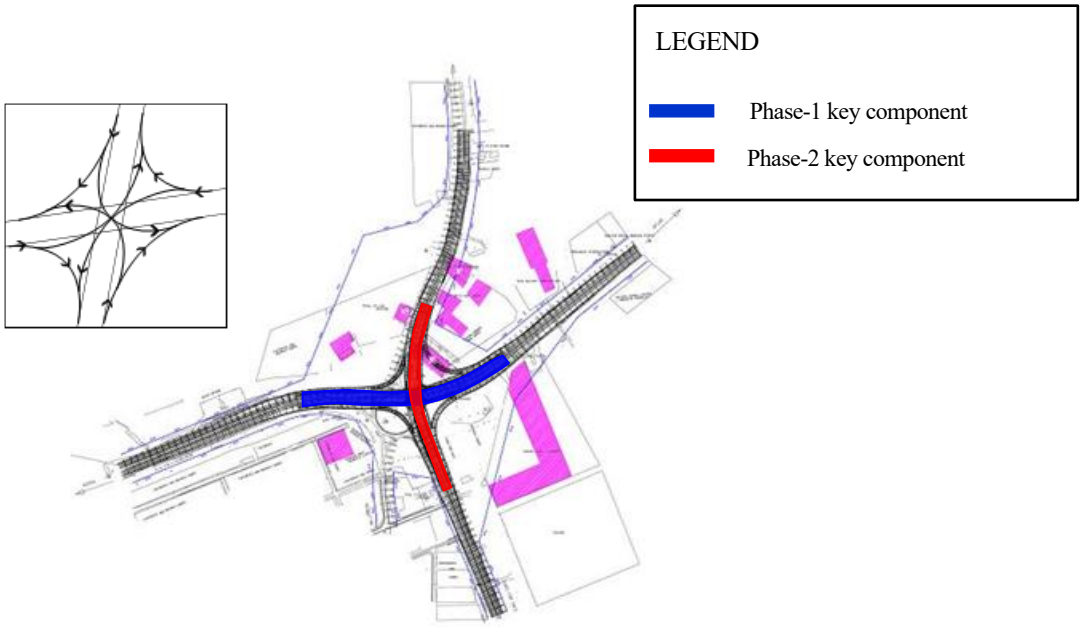


Figure 1.5-1 Outline diagram of intersection

1.5.1.2 Baseline of Environmental and Social Considerations

(1) Land use

The survey area is located at Tema in the Greater Accra region and is straddled by the Tema, Kpone Katamanso and Ashaiman assemblies. Tema is located in the southwest, Kpone Katamanso in the south-east and Ashaiman in the north of Tema Roundabout. It is a convergence point of the National Roads N1 and Akosombo and urban road (Harbour Road). The section of National Road N1 is an access-controlled Motorway. The convergence point used to be a roundabout, which is now being improved under Phase-1 by a 2-tier intersection. Originally, the target area of the Project used to be a roundabout. This roundabout underwent temporary improvement (provision of slip roads for providing free flow of vehicles turning right from each legs of the roundabout) under project carried out by Meridian Port Service. Currently, construction works to improve the roundabout by converting it to a 2-tier intersection is ongoing. This is being done under the Phase-1 project. This survey is the continuity of Phase-1 project which is undertaking a study to check the viability of the project that will put a flyover over the underpass constructed in Phase-1. The target area of Phase-2 lies within the ROW of Phase-1, to be precise in the middle of the Phase-1 area. Figure 1.5-2 shows the target area of this survey.

Figure 1.5-2 Comparison of ROW on Phase-1 and Phase-2

(2) Natural Environment

Natural environmental survey on Phase-1 conducted includes the weather condition, geography, fauna and flora etc. As the results of survey, protected natural environment and/or rare species were not found in the ROW. The impact to natural environment on Phase-2 is more limited due to after Phase-1 condition is basis.

(3) Social Environment

On Phase-1, the area around Tema intersection is within the Tema Development Corporation (TDC)

Acquisition area managed by long-term lease hold, therefore problems associated with ownership of land are not anticipated to be high. However, there are some simple business stores within the ROW. The most prominent ones are facilities such as fast food joints, filling stations, bus terminals, sale of used cars and heavy machinery for hiring, and mechanic shops for car repairs that are related to transportation. The designated Tema Heavy Industry Area (about 50 km^2) lies southeast of Tema intersection. The open spaces, particularly between the Tema - Aflao Road and Tema - Akosomobo Road, are full of vendors/small shops.

Basic understanding on Phase-2 does not require re-settlement of stores due to completion of settlement of all stores during Phase-1.

1.5.2 The System and Administration on Environmental and Social Consideration

1.5.2.1 Laws Relevant to Environmental and Social Consideration

Major law and regulation related environmental and social consideration is below. These systems are the for Phase-1 survey.

- Environmental Protection Agency Act (Act 490 of 1994).
- Environmental Assessment Regulations LI 1652, 1993, and (Amendment) LI 2206, 2013
- Environmental Assessment in Ghana, a Guide to Environmental Impact Assessment Procedures" (EPA, 1996)

1.5.2.2 Administrative Divisions Relevant to Environmental Protection

Supervision of environmental administration works is managed by Environmental Protection Agency (EPA) under Ministry of Environment, Science and Technology established under Environmental Protection Agency Act 1994, Act 490 in Ghana. EPA is structured into six divisions namely;

- Environmental Compliance and Enforcement Division
- Inter-Sectoral Network Division
- Chemicals Control Management Centre
- Programs Planning Monitoring and Evaluation Division
- Finance and Administration Division
- Field Operations (13 regional offices: 3 regions and 10 zonal offices)

1.5.3 Environmental Standard

Environmental standards related environment and social consideration in Ghana are shown below, and some of these standards are considering updating for 2016 version from 2007 version.

- Ambient air standard
- National ambient noise level standards
- National sector specific effluent quality draft standards
- Point Source/Stack Air Emissions Standards

Table 1.5-1 Ambient air standard (2016 version)

Substance	Averaging Time		Time Weighed Average (TWA)
Sulphur Dioxide (SO_2)	Industrial Residential	1 hr 1 hr	520 µg/m^3 **Adopted for all zones**
	Industrial Residential	24 hr	150 µg/m^3 **Adopted for All zones**
	Industrial Residential	1 yr	80 µg/m^3 **Adopted for all zones**
Nitrogen Oxides (Measured as NO_2)	Industrial Residential	1 hr. 1 hr.	250 µg/m^3 **Adopted for all zones**
	Industrial Residential	24 hr 24 hr	150 µg/m^3 **Adopted for all zones**
Total Suspended Particulate	Industrial Residential	24 hr 24 hr	150 µg/m^3 **Adopted for all zones**
	Industrial Residential	1 yr 1 yr	80 µg/m^3 **Adopted for all zones**
PM_{10}		24 hr 1 Yr	70 µg/m^3 **Adopted for all zones** 70 µg/m^3 **Adopted for all zones**
$PM_{2.5}$		24hr	35 µg/m^3 **Adopted for all zones**
Smoke	Industrial Residential	24 hr 24 hr	100 µg/m^3 **Adopted for all zones**
Black Carbon	Industrial Residential	24hr	35 µg/m^3
Carbon Monoxide		15 min 30 min 1 hr 8 hr	100 mg/m^3 60 mg/m^3 30 mg/m^3 10 mg/m^3 **Adopted**
Benzene		1 yr	5 µg/m^3 **Adopted**
Hydrogen Sulphide		24 hr	150 µg/m^3 **Adopted**
Hydrogen Cyanide		24hr	220 µg/m^3 Adopted
Hydrogen Chloride		24hr	20 µg/m^3
Mercury (and its compounds)		24hr 1 yr	15 ng/m^3 **Adopted** 1 µg/m^3 **Adopted**
Lead		24hr 1 yr	1 µg/m^3 for 24 hrs. **Adopted**
Cadmium		1 yr	5 ng/m^3 **Adopted**
Manganese		24 hr	1 µg/m^3 **Adopted**
Dichloromethane (Methylene Chloride)		24 hr	3 mg/m^3 **Adopted**
1,2-Dichloroethane		24 hr	0.7 mg/m^3 **Adopted**
Trichloroethane		24 hr	0.7 mg/m^3 **Adopted**
Tetra chloroethane		24 hr	5 mg/m^3 **Adopted**
Toluene		24 hr	8 mg/m^3
Arsenic	Industrial Residential	24 hr 24 hr	15 ng/m^3 **Adopted for all zones**
Fluoride		24 hr	**10 µg/m^3 Adopted**
Ozone		8 hr 1 hr	**100 µg/m^3 Adopted for all zones** 160 µg/m^3 **Adopted**
Nickel		1 yr	20 ng/m^3 **Adopted**
PAH		1 hr	1 ng/m^3 Adopted
Xylene		1 yr	700 µg/m^3
Dioxins/Furans		24hr 1 yr	0.1 pg TEQ/m^3 0.6 pg TEQ/m^3
Total PCB		24 hr 1 yr	0.6 pg TEQ/m^3 0.035 µg/m^3

National ambient noise level standards was updated in the version 2016, but the values of noise did not change from the version 2007.

Table 1.5-2 National ambient noise level standards

Target area	Noise level (LAeq): Unit: dB	
	Day time (6:00~22:00)	Night time (22:00~6:00)
Residential area	55	48
Educational (school) and health (hospital, clinic) facilities , office and courts	55	50
Mixed used (Residential areas with some commercial or light industrial activities).	60	55
Areas with some light industry, places of entertainment or public assembly, and places of worship located in this zone	65	60
Commercial areas	75	65
Light industrial areas	70	60
Heavy industrial areas	70	70
Noise level standard in Japan (roadside area) (Reference)	70	65
Limit of vehicle noise in noise regulation (Reference)	75	70
Limit of noise level of specific construction area in Japan (Reference)	85	-

Source：Ghana's National Implementation Plan (NIP) for the Stockholm Convention on Persistent Organic Pollutants, 2016 EPA

1.5.4 Procedure on Environmental Assessment

According to the Environmental Assessment Regulations 1999, LI 1652 of Ghana, all developmental projects which will cause significant environmental impacts have to undergo the EIA procedure prior to project implementation.

Environmental Permit for implementation of the Project has been acquired in Phase-1. This environmental permit covers the entire 3-tier grade separation of Tema Motorway Roundabout including construction works/ project of phase-1 and Phase-2. The Survey Team together with GHA had discussed with EPA and confirmed with EPA that Phase-2 does not require to obtain a separate environmental permit including IEE for Phase-2 for the above reason. However, the permit issues are valid for 18 months and need to be renewed every 18 months until the construction of Phase-2 components is completed. The permit was issued in December 2017. Therefore, the timings of renewals in every 18 months are as shown in Figure 1.5-3.

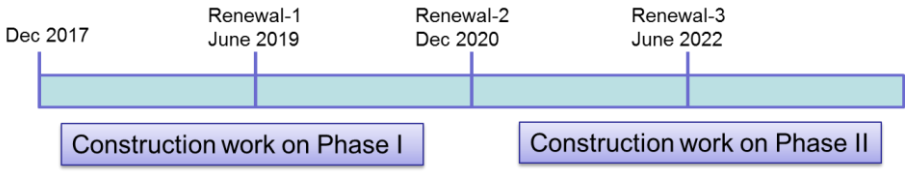


Figure 1.5-3 Renewal period of environmental permit

1.5.5 Scoping

Scoping is necessary for evaluating the impact of the project before its commencement ordinarily. Phase-2 follows the results of scoping of Phase-1 by the reasons below.

- ✓ Target area of Phase-2 is within the ROW or within the construction limits of Phase-1.
- ✓ The environmental impact will be small compared with Phase-1
- ✓ No separate environmental permit for Phase 2 is required as the permit issued during Phase 1 is also valid for Phase 2.
- ✓ According to results of Phase-1 monitoring data, changing the assessment results for environmental impact is not necessary

Scoping results at Phase-1 are shown in Table 1.5-3 for reference.

Table 1.5-3 Scoping Result

Category	No.	Impact Item	Assessment		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	
Pollution	1	Air pollution	B-	B±	**Construction Phase:** Emission of dust and exhaust gas will increase due to construction equipment operations and traffic congestion in construction site. **Operation Phase:** In the future, the total amount of air pollutant caused by vehicle exhaust gas will increase. However, because of improved traffic efficiency, the amount may be reduced compared to current situation.
	2	Water pollution	B-	D	**Construction Phase:** Turbid water will be generated during rainfall periods. However, because there are no water resource areas, rivers and lakes in and around the project site, impact of turbid water caused by construction works will be very limited. **Operation Phase:** Because water quality of drains will not change significantly, water pollution is unlikely to occur.
	3	Waste	B-	D	**Construction Phase:** Construction waste caused by construction and demolition works, and general waste from construction office will be generated. **Operation Phase:** Considerable generation of solid waste is unlikely to occur.
	4	Soil pollution	D	D	Because materials that may cause soil pollution such as heavy metal and toxic organic matter will not be used in the construction and maintenance works, soil pollution is unlikely to occur.
	5	Noise and vibration	B-	B±	**Construction Phase:** Construction equipment operation will cause noise and vibration. **Operation Phase:** Increased traffic volume and speed will elevate noise level. However, decrease in horning frequency, the noise level might be reduced compared to current situation.
	6	Ground subsidence	D	D	Because the ground is hard and groundwater withdrawal will not be included, ground subsidence is unlikely to occur.
	7	Offensive odors	D	D	Because materials and equipment that may cause offensive odors will not be used in construction and maintenance works, considerable offensive odors are unlikely to occur.
	8	Bottom sediment	D	D	Because there are no rivers and lakes near by the project site, considerable impacts of turbid water caused by construction works or drainage form roads in operation phase on bottom sediment are unlikely to occur.

Category	No.	Impact Item	Assessment		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	
Natural Environment	9	Protected areas	D	D	Sakumo Ramsar Site (1,364 hectares) is located in a lagoon of approximately 1.5 km southwest from Tema roundabout. However, because the zone between the lagoon and Tema roundabout comprise residential and industrial area and drainage from Tema roundabout does not flow into the lagoon, impact on ecosystem in the Ramsar site is unlikely to occur.
	10	Ecosystem	D	D	Felling of roadside trees including Neem, Rain Tree and Royal Poinciana will be required in construction phase. However, Impact on urban ecosystem created around Tema roundabout will be very limited.
	11	Hydrology	D	D	**Construction Phase:** Considerable impact on ground water of pilling works is unlikely to occur. **Operation Phase:** Drainage system for rain water will not change significantly.
	12	Geographical features	D	D	Existing geographical features will not change considerably. Existing quarry site and borrow pit will be used for aggregate.
Social Environment	13	Resettlement/ Land Acquisition	B-	D	**Pre-Construction Phase:** Because there are no living quarters around Tema roundabout, number of resettlement of dwellers will be small. However, 150 simple business stores including kiosk, container shops, parasol shops and stallkeeper openings around Tema roundabout will be removed temporarily or relocated. Moreover, removal of commercial or office buildings and gas stations may be required. **Operation Phase:** Additional resettlement and land acquisition will not be required.
	14	Impoverished/ Poor people	B±	D	**Construction Phase:** Disturbance in daily activities of street vendors which include impoverished people is likely to occur. Construction will create job opportunities to the poor as unskilled labor. **Operation Phase:** Considerable impact only on impoverished people is unlikely to occur.
	15	Ethnic minorities and indigenous peoples	D	D	Because the project is located in developed areas, considerable impact on ethnic minorities or indigenous peoples is unlikely to occur.
	16	Local economies, such as employment, livelihood, etc.	B±	B+	**Construction Phase:** Business activities of a gas station, several offices, shops and street vendors around Tema roundabout will be closed or suspended. Construction will create job opportunities to local people as unskilled labor. **Operation Phase:** Reduction of travel time by mitigated traffic jam will contribute to local economies. Adaptation of a new intersection configuration will change the land use plan.
	17	Land use and utilization of local resources	B-	B±	**Construction Phase:** Land acquisition will require change of land use such as from commercial area to road reserve. As a result, local resources will be partially lost. **Operation Phase:** Improved transportation will contribute to effective utilization of local resources. Adaptation of a new intersection configuration will change the land use plan.
	18	Water usage	D	D	Because there are no water resources around Tema Roundabout, considerable impact on water rights and its usage is unlikely to occur.

Category	No.	Impact Item	Assessment		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	
	19	Existing social infrastructures and services	B-	B-	**Pre-Construction Phase:** Relocation or protection of utilities (service lines) such as water and sewer pipes, electric cable, telephone line and gas pipe will be required. **Construction Phase:** Temporary traffic congestion, shift of bus and taxi stations, and disturbance of access to roadside facilities will occurred. **Operation Phase:** Crossing of roads by pedestrians would only be allowed at designated places (footbridge).
	20	Social institutions such as social infrastructure and local decision-making institutions	D	D	Because the project is located in a developed area, considerable impact on social institutions is unlikely to occur.
	21	Misdistribution of benefits and damages	C-	C-	Because the project lies in a developed area, considerable misdistribution of benefit among local people is unlikely to occur. However, misdistribution of benefit between relocated and remaining business stores may occur.
	22	Local conflicts of interest	C-	C-	Because the project lies in a developed area, considerable impact due to local conflict is unlikely to occur. However, local conflict between relocated and remaining business stores may occur.
	23	Cultural heritage	D	D	There are no cultural heritages around Tema Roundabout.
	24	Landscape	B-	D	**Construction Phase:** Loss of vegetation and construction work will change the landscape. **Operation Phase:** Appearance of footbridges will change the landscape. However, as Tema roundabout is located in commercial and industrial areas, particular landscape conservation measures will not be required.
	25	Gender	D	D	Because the project is improvement works of existing roundabout, considerable impact only on gender is unlikely to occur.
	26	Children's rights	D	D	Because the project is improvement works of existing roundabout, considerable impact only on children's rights is unlikely to occur.
	27	Infectious diseases such as HIV/AIDS	D	D	Increased earning power may encourage workers to have multiple sexual partners. This phenomenon may expose workers and the community to HIV and other STI's.
	28	Working conditions (including occupational safety)	B-	D	**Construction Phase:** Impact of waste from construction workers on sanitary conditions around the construction site is likely to occur. Because construction will include works in heights, various accidents may occur. **Operation Phase:** Road operation will not have impacts on working conditions.
	29	Accidents	B-	B±	**Construction Phase:** Labor accident, including tumble accident may involve pedestrians and street vendors **Operation Phase:** Decrease of minor accidents in Tema Roundabout will be expected. On the other hand, traffic accident may increase in newly constructed intersection at the initial stage.
Other	30	Trans-boundary impacts or climate change	D	D	Trans-boundary impacts such as climate change are unlikely to occur.

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the

study progresses)

D: No impact is expected

* Impact Items refer to "JICA Guidelines for Environmental and Social Considerations April 2010"

1.5.6 Survey Plan on Environmental and Social Considerations

The result of baseline survey of environment and social considerations of Phase 1 is adopted for Phase-2 as the scoping items are similar. The survey methodology of Phase-1 is shown in Table 1.5-4.

Table 1.5-4 Method and Contents of the survey

Category	No.	Impact item	Assessment		Monitoring item/ parameter	Method
			Pre-Construction Phase Construction Phase	Operation Phase		
Pollution	1	Air pollution	B-	B±	1. Ambient air quality 2. Environment standard 3. Affect of construction 4. Forecasting traffic condition in future	・Exsiting data ・Measurement of NO_2 in roadside ・Confirmation of construction contents and the method ・Prediction of pollution load based on future traffic
	2	Water pollution	B-	D	1. water quality 2. Influence by construction	・Survey of exsting data ・Confirmation of effluent on road side ・Confirmation of construction method and components
	3	Waste	B-	D	1. Treatment method of waste around construction site	・Hearing to staff ・Survey of similar countermeasure
	4	Noise and Vibration	B-	B±	1. Noize and vibration 2. Environmental standard 3. Hospital and school 4. Influence by construction	・Survey of exsting data ・Measuerment of noise level on road side ・Predict of nosie level based on future traffic ・Confirmation of construction method and components
Social Environment	1	Resettlement/ Land Acquisition	B-	D	1. Scale of resettlement 2. Preparation of abbreviated resettlement action plan	・Survey of related regulations ・Survey of socila economic ・Survey of resttelment cost ・Hearing of stakeholders ・Survey of similar countermeasure
	2	Impoverished/Poor people	B±	D	1. Living conditions of affected residents	・Survey of social economic ・Survey of exsting data ・Survey of similar countermeasure
	3	Local economies, such as employment, livelihood, etc.	B±	B+	1. Living conditions of affected residents 2. Economic condition around target area 3. Situation of vehicles and pedestrians crossing the road 4. Inflence of improvement of intersection	・Survey of social economic ・Survey of exsting data ・Field survey ・Survey of similar countermeasure

Category	No.	Impact item	Assessment		Monitoring item/ parameter	Method
			Pre-Construction Phase Construction Phase	Operation Phase		
	4	Land use and utilization of local resources	B-	B+	1. Land use of target area 2. Social economic condition	・Field survey ・Survey of exsting data ・Hearing to steakholders ・Survey of similar countermeasure
	5	Existing social infrastructures and services	B-	B-	1. Utilities condition on road side 2. Situation of vehicles and pedestrians crossing the road 3. Inflence of improvement of intersection	・Field survey ・Survey of exsting data ・Hearing of stakeholders ・Survey of similar countermeasure
	6	Misdistribution of benefits and damages	C-	C-	1. Living conditions of affected residents 2. Preparation of abbreviated resettlement action plan	・Survey of social economic ・Survey of exsting data ・Survey of similar countermeasure
	7	Local conflicts of interest	C-	C-	1. Living conditions of affected residents 2. Preparation of abbreviated resettlement action plan	・Survey of social economic ・Survey of exsting data ・Survey of similar countermeasure
	8	Landscape	B-	D	1. Distribution of tree 2. Procedure related to tree cutting	・Field survey ・Survey of exsting data ・Hearing of stakeholders
	9	Working conditions (including occupational safety)	B-	D	1. Labour condition	・Hearing of stakeholders ・Survey of similar countermeasure
	10	Accidents	B-	B±	1. Occupational accident 2. Number of traffic accidents	・Survey of exsting data ・Hearing of stakeholders ・Survey of similar countermeasure

1.5.7 The Survey Results of Environmental and Social Considerations

1.5.7.1 The Survey Results of Phase-1

The baseline survey for air quality and noise level was conducted in 2015 during Phase-1. According to the monitoring results by EPA, seasonal change of air pollution is few. Furthermore, concentration of Pb and Mn is low, and the levels of O_3, SO_2, NO_2, and CO are not noticeable. Because emission of pollution load is not so much, additionally the pollutants be diffusion by sea wind. In measurement results, of 80% of commercial area and roadside and 40% of residential area were violated on the environmental standard of PM10 in Ghana. The pollutant source will be estimated emission from exhaust gases of vehicles. Other pollutant source will be estimated emission from industries, smoke from the field and Harmattan.

The Survey Team measured the quality of air around Tema in December 2015. PM10 and Total Suspended Particular matter (TSP) exceeded the threshold of the environmental standard values in Ghana. Currently, the

Ghana's environmental standard is under the process of updating to version 2016.

Table 1.5-5 Measurement Result of ambient air around Tema (December 2015)

Parameter	Tema roundabout	Env. Standard in Ghana (Ave. 24hr)	WHO Guideline
NO_2 (μg/m^3)	4.1	150	200 (Ave, 1hr)
SO_2 (μg/m^3)	52.5	150	20
PM10 (μg/m^3)	150	70	50
TSP (μg/m^3)	290	230 (2007) 150 (2016)	-

Measurement of noise level conducted at 5 points in and around Tema Roundabout under this survey indicates that the noise levels except for the measurement point at the center of the roundabout exceeded 75dB (as Aeq), which is the Permissible Noise Level in predominantly commercial areas.

Table 1.5-6 Noise level around Tema roundabout

Date	10:00 m-11:00 am, 10th Dec. 2015			2:00 pm-3:00 pm, 10th Dec, 2015		
Place	L Aeq (dB)	Max (dB)	Min (dB)	L Aeq (dB)	Max (dB)	Min (dB)
No. 1	76	87	62	79	89	69
No. 2	78	90	63	76	84	65
No. 3	76	85	68	80	95	67
No. 4	76	86	60	75	84	61
No. 5	61	72	53	69	85	59

1.5.7.2 Monitoring results on Phase-1

Monitoring results of construction phase in February 2019 are shown in Table 1.5-7. The monitoring results show no significant impact on construction according to comparison with baseline.

Table 1.5-7 Monitoring results on construction phase (February 2019)

Parameter / Monitoring place	PM10 (μg/m^3)	PM2.5 (μg/m^3)	NOx (μg/m^3)	SOx (μg/m^3)	Noise (L_{MAX})	Vibration (VdB)
Harbour Road	83.3	55.5	N.D.	N.D.	67.7	11.4
Aflao Road	133.0	61.8	N.D.	N.D.	68.1	11.1
Akosombo Road	90.2	48.5	N.D.	N.D.	79.9	12.4
Motorway	78.9	41.6	N.D.	N.D.	79.1	14.7
EPA standard value	70	35	150 as NO_2	150 as SO_2	70	75 in Japan

1.5.8 Environmental Impact Assessment

Environmental impact was assessed based on baseline survey results and monitoring results of Phase-1.

Table 1.5-8 Assessment results

Category	No.	Impact Item	Assessment results in 2015		Assessment results in 2019		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	Pre-Construction Phase Construction Phase	Operation Phase	
Pollution	1	Air pollution	B-	B±	B-	B±	**Construction Phase:** Emission of dust and exhaust gas will increase due to construction equipment operations and traffic congestion in construction site. **Operation Phase:** In the future, the total amount of air pollutant caused by vehicle exhaust gas will increase. However, because of improved traffic efficiency, the amount may be reduced compared to current situation.
	2	Water pollution	B-	D	B-	D	**Construction Phase:** Turbid water will be generated during rainfall periods. However, because there are no water resource areas, rivers and lakes in and around the project site, impact of turbid water caused by construction works will be very limited. **Operation Phase:** Because water quality of drains will not change significantly, water pollution is unlikely to occur.
	3	Waste	B-	D	B-	D	**Construction Phase:** Construction waste caused by construction and demolition works, and general waste from construction office will be generated. **Operation Phase:** Considerable generation of solid waste is unlikely to occur.
	4	Soil pollution	D	D	D	D	Because materials that may cause soil pollution such as heavy metal and toxic organic matter will not be used in the construction and maintenance works, soil pollution is unlikely to occur.
	5	Noise and vibration	A-	B±	B-	B±	**Construction Phase:** Construction equipment operation will cause noise and vibration, but the impact is not big according to monitoring results. **Operation Phase:** Increased traffic volume and speed will elevate noise level. However, decrease in horning frequency, the noise level might be reduced compared to current situation.
	6	Ground subsidence	D	D	D	D	Because the ground is hard and groundwater withdrawal will not be included, ground subsidence is unlikely to occur.
	7	Offensive odors	D	D	D	D	Because materials and equipment that may cause offensive odors will not be used in construction and maintenance works, considerable offensive odors are unlikely to occur.
	8	Bottom sediment	D	D	D	D	Because there are no rivers and lakes near by the project site, considerable impacts of turbid water caused by construction works or drainage form roads in operation phase on bottom sediment are unlikely to occur.
Natural Environment	9	Protected areas	D	D	D	D	Sakumo Ramsar Site (1,364 hectares) is located in a lagoon of approximately 1.5 km southwest from Tema roundabout. However, because the zone between the lagoon and Tema roundabout comprise residential and industrial area and drainage from Tema roundabout does not flow into the lagoon, impact on ecosystem in the Ramsar site is unlikely to occur.
	10	Ecosystem	D	D	D	D	Felling of roadside trees including Neem, Rain Tree and Royal Poinciana will be required in construction phase. However, Impact on urban ecosystem created around Tema roundabout will be very limited.

Category	No.	Impact Item	Assessment results in 2015		Assessment results in 2019		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	Pre-Construction Phase Construction Phase	Operation Phase	
	11	Hydrology	D	D	D	D	**Construction Phase:** Considerable impact on ground water of pilling works is unlikely to occur. **Operation Phase:** Drainage system for rain water will not change significantly.
	12	Geographical features	D	D	D	D	Existing geographical features will not change considerably. Existing quarry site and borrow pit will be used for aggregate.
Social Environment	13	Resettlement/ Land Acquisition	B-	D	B-	D	**Pre-Construction Phase:** Because there are no living quarters around Tema roundabout, number of resettlement of dwellers will be small. However, 150 simple business stores including kiosk, container shops, parasol shops and stallkeeper openings around Tema roundabout will be removed temporarily or relocated. Moreover, removal of commercial or office buildings and gas stations may be required. **Operation Phase:** Additional resettlement and land acquisition will not be required.
	14	Impoverished/Poor people	B±	D	B±	D	**Construction Phase:** Disturbance in daily activities of street vendors which include impoverished people is likely to occur. Construction will create job opportunities to the poor as unskilled labor. **Operation Phase:** Considerable impact only on impoverished people is unlikely to occur.
	15	Ethnic minorities and indigenous peoples	D	D	D	D	Because the project is located in developed areas, considerable impact on ethnic minorities or indigenous peoples is unlikely to occur.
	16	Local economies, such as employment, livelihood, etc.	B±	B+	B±	B+	**Construction Phase:** Business activities of a gas station, several offices, shops and street vendors around Tema roundabout will be closed or suspended. Construction will create job opportunities to local people as unskilled labor. **Operation Phase:** Reduction of travel time by mitigated traffic jam will contribute to local economies. Adaptation of a new intersection configuration will change the land use plan.
	17	Land use and utilization of local resources	B-	B±	B-	B±	**Construction Phase:** Land acquisition will require change of land use such as from commercial area to road reserve. As a result, local resources will be partially lost. **Operation Phase:** Improved transportation will contribute to effective utilization of local resources. Adaptation of a new intersection configuration will change the land use plan.
	18	Water usage	D	D	D	D	Because there are no water resources around Tema Roundabout, considerable impact on water rights and its usage is unlikely to occur.
	19	Existing social infrastructures and services	B-	B-	B-	**B±**	**Pre-Construction Phase:** Relocation or protection of utilities (service lines) such as water and sewer pipes, electric cable, telephone line and gas pipe will be required. **Construction Phase:** Temporary traffic congestion, shift of bus and taxi stations, and disturbance of access to roadside facilities will occurred. **Operation Phase:** Crossing of roads by pedestrians would only be allowed at designated places (footbridge). **The other hand, the safety of pedestrians will be improved.**

Category	No.	Impact Item	Assessment results in 2015		Assessment results in 2019		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	Pre-Construction Phase Construction Phase	Operation Phase	
	20	Social institutions such as social infrastructure and local decision-making institutions	D	D	D	D	Because the project is located in a developed area, considerable impact on social institutions is unlikely to occur.
	21	Misdistribution of benefits and damages	C-	C-	C-	C-	Because the project lies in a developed area, considerable misdistribution of benefit among local people is unlikely to occur. However, misdistribution of benefit between relocated and remaining business stores may occur.
	22	Local conflicts of interest	C-	C-	C-	C-	Because the project lies in a developed area, considerable impact due to local conflict is unlikely to occur. However, local conflict between relocated and remaining business stores may occur.
	23	Cultural heritage	D	D	D	D	There are no cultural heritages around Tema Roundabout.
	24	Landscape	B-	D	B-	D	**Construction Phase:** Loss of vegetation and construction work will change the landscape. **Operation Phase:** Appearance of footbridges will change the landscape. However, as Tema roundabout is located in commercial and industrial areas, particular landscape conservation measures will not be required.
	25	Gender	D	D	**B+**	D	Consideration for gender equality is being for providing proper working environment and equal opportunity from the beginning of the project till date.
	26	Children's rights	D	D	D	D	Because the project is improvement works of existing roundabout, considerable impact only on children's rights is unlikely to occur.
	27	Infectious diseases such as HIV/AIDS	D	D	D	D	Because the project site is located in a well developed urban area, new considerable influx of infected persons as construction worker will not occur.
	28	Working conditions (including occupational safety)	B-	D	B-	D	**Construction Phase:** Impact of waste from construction workers on sanitary conditions around the construction site is likely to occur. Because construction will include works in heights, various accidents may occur. **Operation Phase:** Road operation will not have impacts on working conditions.
Others	29	Accidents	B-	B±	B-	B±	**Construction Phase:** Labor accident, including tumble accident may involve pedestrians and street vendors **Operation Phase:** Decrease of minor accidents in Tema Roundabout will be expected. On the other hand, traffic accident may increase in newly constructed intersection at the initial stage.

Category	No.	Impact Item	Assessment results in 2015		Assessment results in 2019		Reason / Remarks
			Pre-Construction Phase Construction Phase	Operation Phase	Pre-Construction Phase Construction Phase	Operation Phase	
	30	Trans-boundary impacts or climate change	D	D	D	D	Trans-boundary impacts such as climate change are unlikely to occur.

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected

* Impact Items refer to "JICA Guidelines for Environmental and Social Considerations April 2010"

The updated assessment results were show in bold based on monitoring results.

1.5.9 Major Mitigation Measures and Cost

There is no significant change in the assessment results between for Phase-1 and for Phase-2. Therefore, the mitigation method on Phase-2 will be applied to the same method of Phase-1 as shown in Table 1.5-9. The issues regarding abbreviated resettlement are not included in Phase-2 as there is no resettlement required in Phase-2. The resettlement issues of Phase-1 were completely resolved as of August 2019.

Table 1.5-9 Major Mitigation Measures and Cost

Category	No.	Impact item	Mitigation Measures	Cost (US$)
Pollution	1	Air pollution	**Construction Phase:** ・Contractor shall conduct countermeasure for dust such as watering. ・Contractor shall put in effort to reduce exhaust gases from construction machinery with appropriate maintenance and using to electric machinery. ・Contractor shall put in effort to reduce dust by maintaining clean road and controlling velocity of construction machinery. ・Contractor shall be explaining the construction plan to residence living around the site and supervising consultant in advance. ・Supervising consultant shall be reviewing the construction method with contractor referring to residence's opinions, if need. **Operation Phase** ・GHA shall conduct air monitoring on all sides. ・EPA shall consider enhancing the regulation of environmental standard on dust and exhaust gases, if need.	**Construction Phase:** Air monitoring cost 3,600 (6 times) other cost shall be including to construction contract **Operation Phase** Air monitoring cost 2,400 (4 times/2 years)
	2	Water pollution	**Construction Phase:** ・Construction work near river shall be conducted in the dry season as possible. ・Contractor shall maintain proper construction machinery to avoid oil and fuel leakage.	**Construction Phase:** other cost shall be included in the construction contract

Category	No.	Impact item	Mitigation Measures	Cost (US$)
			・Contractor shall manage the oil and fuel properly. ・Cleaning machinery in river is prohibited. ・Supervising consultant shall consider proper drainage plan in advance. ・Contractor shall be plant grasses and flowers on road slopes and pit in order to prevent soil runoff. ・Contractor and supervising consultant shall be monitoring the occurring condition of dirty water and review the construction method, if needed.	
	3	Waste	**Construction Phase:** ・Contractor shall conduct proper waste management ・Contractor shall prepare toilet and waste management space in construction site ・Contractor shall collect separately solid waste materials ・Contractor shall consider reuse and recycle of construction waste ・Contractor and supervising consultant shall be monitoring the waste treatment method and improve the treatment method, if needed.	**Construction Phase:** other cost shall be included in the construction contract
	4	Noise and Vibration	**Construction Phase:** ・Contractor shall make construction plan to avoid concentrating many construction machineries for long near residential area ・Contractor shall maintain proper condition of the construction machineries to avoid abnormal noise ・Construction work in night is prohibited near residential area ・Contractor shall select the low noise machinery as possible ・Contractor and supervising consultant shall explain construction plan to residence around the site in advance ・Contractor and supervising consultant shall be monitoring the noise, vibration with residence's opinion and reviewing the construction method, if needed **Operation Phase** ・GHA shall maintain properly the road ・GHA shall monitor the noise and vibration level along road if the results violate significantly the environmental standard. GHA must consider countermeasures for mitigation such as planting.	**Construction Phase:** Noise monitoring cost 6,000 (6 times) Vibration monitoring cost 6,000 (6 times) other cost shall be included in the construction contract **Operation Phase** Noise monitoring cost 2,000 (2 times/2 years) Vibration monitoring cost 2,000 (2 times/2 years)
Social Environment	1	Resettlement/ Land Acquisition	**Pre-Construction Phase** ・Abbreviated resettlement action plan shall be prepared and implanted properly	the cost estimation in Phase-1 app. 820,000 (GH₵ 3,112,786) **In Phase-2 does not require resettlement**
	2	Impoverished/Poor people	**Construction Phase:** ・Disclose information on construction plans and off-limits areas, etc. to ensure safety for street vendors that belong to the poverty zone。	other cost shall be including to construction contract
	3	Local economies, such as employment, livelihood, etc.	**Pre-Construction Phase** ・Abbreviated resettlement action plan shall be prepared and implanted properly **Construction Phase:** ・Contractor shall conduct fair employment when hiring local residents as a simple worker for construction work. ・Contractor and supervising consultant shall explain construction plan to residence around the site in advance	the cost is including to construction contract and resettlement budget
	4	Land use and utilization of local resources	**Pre-Construction Phase** ・Abbreviated resettlement action plan shall be prepared and implanted properly **Operation Phase** ・Consultants for detail design shall submit necessary information to TDC in early stage for up-date on the land use plan such as the final design of Tema roundabout and prediction results of traffic	the cost is included in the construction contract and resettlement budget

Category	No.	Impact item	Mitigation Measures	Cost (US$)
	5	Existing social infrastructures and services	**Pre-Construction Phase** ・ Consult with the owners of existing infrastructure facilities such as telephone poles, water pipes, and optical cables to implement with develop relocation and protection plans. **Construction Phase:** ・ Consultants for detail design will design a temporary road for detour. ・ Contractor shall conduct traffic control to avoid traffic jam ・ Consultants for detail design shall consider temporary land use in construction phase by sharing the construction plan among TDC and related organizations in early stage **Operation Phase** ・ In order to ensure the pedestrians traffic, GHA will improve the sidewalks, if needed ・ GHA shall be monitoring a pedestrian's traffic and shall take countermeasure, if need.	the cost is included in the construction contract or miscellaneous expenses
	6	Misdistribution of benefits and damages	**Pre-Construction Phase** ・ Abbreviated resettlement action plan shall be prepared and implanted properly **Operation Phase** ・ GHA and TDC shall be monitoring living condition of affected people and shall take countermeasure, if needed	the cost is included in the resettlement budget **In Phase-2 does not require the resettlement**
	7	Local conflicts of interest	**Pre-Construction Phase** ・ Abbreviated resettlement action plan shall be prepared and implanted properly **Operation Phase** ・ GHA and TDC shall be monitoring living condition of affected people and shall take countermeasure, if needed	the cost is included in the resettlement budget **In Phase-2 does not require the resettlement**
	8	Landscape	**Construction Phase:** ・ Supervising consultant and contractor shall consider minimizing cutting of trees under the construction plan. ・ Contractor shall plant green grasses along the roadside and slope on road.	other cost shall be included in the construction contract
	9	Working conditions (including occupational safety)	**Construction Phase:** ・ Supervising consultant and contractor shall conduct preventive countermeasures on accident before construction. ・ Contractor shall sprinkle water on the grass as a countermeasure for dust ・ Contractor shall prepare toilet and dumping site in construction site.	other cost shall be included in the construction contract
Others	1	Accidents	**Construction Phase:** ・ Supervising consultant and contractor shall conduct preventive countermeasures on accident before construction. ・ Contractor shall prepare traffic control and setting of traffic signboard for prevention accident **Operation Phase** ・ Traffic signboard shall be understanding easily to driver ・ GHA shall be monitoring traffic accident condition, and shall be make countermeasure, if need.	the cost is included in the construction contract or miscellaneous expenses

1.5.10 Environmental Monitoring Plan

Conducting monitoring activities is to obtain basic information for assessment of Environmental Impact and it is a requirement of Environmental Permission in Ghana. The monitoring results were submitted to EPA for renewal of the environmental permission in June 2019. Therefore, the monitoring activities in Phase-2 are

desirable and shall be conducted the same activities of Phase-1.

The current environmental monitoring activity plan is shown in Table 1.5-10.

Table 1.5-10 Environmental Monitoring Plan

Category	Environmental Item	Monitoring Item/ Parameter	Responsible Person and Organization	Location	Method	Frequency
Pollution	Air pollution	**Construction Phase:** ・Dust ・PM10、PM2.5、NOx、SOx	Supervising Consultant/ Contractor	Construction site	Visual observation and interview of pedestrians Instrumental analysis	Visual observation: Daily Interview: Monthly or as needed Instrumental analysis: Pre-Construction Phase 1 time, Construction Phase 5 times Total 6 times
		Operation Phase: ・PM10、PM2.5、NOx、SOx	GHA	Around Tema intersection.	Instrumental analysis	1 time in dry season and 1 time in rainy season per year for 2 years after completion Total 4 times
	Water pollution	**Construction Phase:** ・Turbid water and drainage conditions	Supervising Consultant/ Contractor	Construction site	Visual observation	During rainfall
	Waste	**Construction Phase:** ・Disposal methods of construction and general waste	Supervising Consultant/ Contractor	Construction site and disposal site	Visual observation and meeting with contractor	Visual observation: Daily Meeting: Monthly or as needed
	Noise and vibration	**Construction Phase:** ・Noise level ・Vibration level	Supervising Consultant/ Contractor	Construction site	Interview to local residents and pedestrians Instrumental measurement	Interview: Monthly or as needed Instrumental measurement: Pre-Construction Phase 1 time, Construction Phase 5 times Total 6 times
		Operation Phase: ・Noise level ・Vibration level	GHA	In and around Tema intersection	Instrumental measurement	1 time per year for 2 years after completion Total 2 times
Social Environment	Resettlement/ Land Acquisition	**Pre-Construction Phase:** ・Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed
	Poor people	**Construction Phase:** ・Activity conditions of street venders	Supervising Consultant/ Contractor	Construction site	Visual observation	Daily
	Local economies, such as employment, livelihood, etc.	**Pre-Construction Phase:** ・Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed

Category	Environmental Item	Monitoring Item/ Parameter	Responsible Person and Organization	Location	Method	Frequency
		Construction Phase: ・ Business activity around construction site ・ Employment situation of unskilled labor	Supervising Consultant/ Contractor	Construction site	Site survey and interview of local people and unskilled labors	Monthly or as needed
	Land use and utilization of local resources	**Pre-Construction Phase:** ・ Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAP	Monthly or as needed
		Operation Phase: ・ Condition of land use ・ Condition of business activity	GHA TDC	In and around Tema intersection	Site survey and interview of local people	Monthly or as needed for 2 years after completion
	Existing social infrastructures and services	**Pre-Construction Phase:** ・ Relocation status of existing infrastructure facilities	GHA	In and around Tema intersection	Site survey and meeting with facility owners	Monthly or as needed
		Construction Phase: ・ Condition of traffic congestion around construction site	Supervising Consultant/ Contractor	Construction site	Visual observation	Daily
		Operation Phase: ・ Crossing conditions of pedestrians	GHA	In and around Tema intersection	Site survey and interview of local people	Monthly or as needed for 2 years after completion
	Misdistribution of benefits and damages	**Pre-Construction Phase:** ・ Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed
		Operation Phase: ・ Living situations of Project Affected Persons (PAPs)	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed for 2 years after relocation
	Local conflicts of interest	**Pre-Construction Phase:** ・ Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed
		Operation Phase: ・ Living situations of Project Affected Persons (PAPs)	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed for 2 years after relocation
	Landscape	**Construction Phase:** ・ Status of tree felling ・ Status of Planting works	Supervising Consultant/ Contractor	Construction site	Visual observation and meeting with contractor	Daily

Category	Environmental Item	Monitoring Item/ Parameter	Responsible Person and Organization	Location	Method	Frequency
	Working conditions (including occupational safety)	**Construction Phase:** ・ Workplace situations ・ Implementation status of accident prevention measures	Supervising Consultant/ Contractor	Construction site	Visual observation and meeting with contractor	Daily
Other	Accidents	**Construction Phase:** ・ Implementation status of accident prevention measures	Supervising Consultant/ Contractor	Construction site	Visual observation and meeting with contractor	Daily
		Operation Phase: ・ Number of traffic accident	GHA	In and around Tema intersection	Site survey and traffic accident data	Monthly or as needed for 2 years after completion

1.5.11 Stakeholder Meeting

The stakeholder meeting was held on 31st of May, 2019 for explanation of the construction schedule and outline of the project. The result of meeting is compiled in Table 1.5-11. This stakeholder meeting was held during the construction period of Phase-1, hence opinions includes the current construction condition. As a general opinion, it can be judged that the project itself has been positively evaluated although there were some requests/opinions with regards to the current construction works in Phase-1.

Table 1.5-11 Summary of stakeholders meeting

Date	31st of May 2019 (Friday) AM 10:30-12:30
Venue	Chicken Licking
Agenda	1. Project background 2. Summary of Project 3. Discussion
Language	Local language/ English
Participant	Total 153participants (Man: 105, Women: 48)
Major discussion/ Recommendation	・ Project timeline and schedule must be provided and should be clearly made visible. ・ Emergency health units should be built at/or close to the site. ・ The temporary fences provided to cordon the construction area of Phase 1 make the Aflao bus station difficult to be seen easily.

Category		Man	Woman	Total
Government sector		19	5	24
Consultant	ABP	2	2	4
	JICA team	6	1	7
Private sector		11	1	12
Residential people		67	39	106

2. Contents of the Project

2.1 Basic Concept of the Project

In July 2013, the Government of Ghana (GOG) requested the Government of Japan (GOJ) to provide grant aid for improvement of the Tema intersection into phases. In response, JICA conducted the 1st preparatory survey in 2015. Based on the survey result, the construction of the underpass in the east-west direction (Motorway-Aflao) and ground intersection for right-left turn has started from February 2018 as first phase of this project, and will be expected completion on June 2020. The second phase of the project will basically follow the plan prepared during the 1st preparatory survey, and build a flyover in north-south direction (Akosombo-Habour) including approach roads.

2.2 Outline Design of the Japanese Assistance

2.2.1 Design Policy

2.2.1.1 Policy against Requested Japanese Assistance

This Survey is conducted to prepare documents for assessment by JICA on the feasibility of the Phase-2 project requested by the GOG. The GOG's request for Phase-2 is to provide a flyover in the north-south direction over the underpass after it has been constructed in Phase-1. As the components of Phase-2 are integral parts of Phase-1, planning and design policies of Phase-1 mostly applies to Phase-2. The timeframe policy of this survey against the request made by GOG for Japanese Assistance are as follows;

- January 2019 to February 2019: Inception Report (IC/R) explanation and first site survey (work in Ghana)
- March 2019 to June 2019: Determination of project Scopes; Outline Design; and Project cost estimate (work in Japan)
- May 2019 to June 2019: Technical design review by GHA; Agreement with GHA on the project scopes; and Second site survey (work in Ghana)
- July 2019 to October 2019: Outline Design and Review of the Outline Design Drawings; and Project cost estimate review by JICA (work in Japan)
- November 2019: Draft Final Report (DF/R) Explanation and Agreement with GHA on the contents of the Outline Design (work in Ghana)

2.2.1.2 Consistency with Phase-1

As explained in the previous sections, improvement of Tema Motorway Roundabout was requested and planned to be implemented in two phases. The scope of this survey only covers the components of Phase-2. However, since both phases are integral parts of the same improvement, both phases need to maintain consistency. Particularly, as Phase-1 is currently under construction, consistency with the components of Phase-1 is inevitable for the planning of Phase-2 components. More precisely, the scope of Phase-2 is to provide a flyover in the north-south direction for through traffics. The location of the flyover should be such

that it meets the vertical clearance requirement and has minimal impact to the ramps and service roads that merges with the Phase-2 road and are currently under construction.

2.2.1.3 Policy on Engineering Surveys

Various engineering surveys were conducted at and around Tema Intersection to ensure accuracy in planning, design, construction planning and estimation for construction of the flyover and its approaches in the north-south direction of the Tema intersection.

The project objective road is located at a nodal point between high standard highways (national roads). The construction is required to be done where the diversion road is adjacent to the construction premises. In addition, since the impact to road users and alongside residents are significant as the volume of existing traffic is high and the road sides are occupied by residents and vendors, it is important that safety and construction efficiency are given proper consideration.

Engineering surveys were conducted to ensure all relevant and necessary data and information are obtained for planning and design while taking the above issues into consideration. The surveyed items, survey purpose, survey location, scale and survey method are summarized in Table 2.2-1.

Table 2.2-1 List of Surveys Conducted

Survey	Purpose	Location	Scope	Methodology
1. Climate/Hydrology	To understand as well as to collect the data for conducting suitable construction planning	In and around Tema Motorway Roundabout	・ Temperature, precipitation, water level of gullies, natural disaster, etc.	Collection of available data and site observation
2. Geo-Technical Investigation	For collecting data to understand the soil properties and its distribution condition for conducting design of pavement and the facilities of the objective road	Areas along objective road and borrow pit	・ Site investigation ・ Drilling, SPT Test ・ Fill material ・ Base course material	Subcontracting
3. Traffic Survey	To collect Traffic data for future traffic demand forecast	On all the roads connecting to Tema Roundabout	・ Counting peak hour traffics	Subcontracting
	To understand traffic behavior at the intersection Roundabout	Existing Ashaiman Roundabout	・ Counting peak hour traffics	Counting traffic volume by vehicle type and direction by AI analysis of videos taken by drone
4. Existing Drainage Survey	To comprehend the existing condition of road incidental facilities so that it could be reflected in the design work	Areas along objective road	・ Study direction of flow ・ Grasp the existing provision of drainage facilities ・ Check on outlets	Collection of available data and site observation

Survey	Purpose	Location	Scope	Methodology
5. Other Surveys	To comprehend the existing condition of road ancillary facilities for design work	In and around the objective intersection	・ Current traffic operation ・ Pedestrian volume ・ Pavement surface condition ・ Land use ・ Gender and Population ・ Economic & industrial survey	Collection of available data and site observation

2.2.1.4 Policy on Outline design

(1) Target year of the Project

The target year of the project is set to 2035, which is the same target year applied during Phase-1. A period of 20 years was considered during the preparatory survey of Phase-1 in 2015.

The future traffic volume which is the basis for determining the scale of the project was estimated in the preparatory survey in Phase-1. This Survey reviewed the future traffic volume taking into account the changes of the site condition beyond the preparatory survey of Phase-1.

(2) Scope of the Project

The scope of Phase-2 project is to improve Tema Intersection (prior to implementation of Phase-1 it was Tema Motorway Roundabout) by providing a flyover and its approach road over the east-west road planned and currently under construction. Other improvements relevant to the project and having synergy effect on the outcome of this project will be suggested to the GOG for undertaking its implementation by the GOG.

(3) Consistency with Existing Plans

From the time of Phase-1 preparatory survey, the Survey Team had collected information on development plans that are expected to have impacts of the Tema Motorway Roundabout. None of these plans had been materialized till the commencement of this Survey. The Team again clarified on the progress and prospective of these plans. Improvement/widening of the Tema Port access road (Hospital Road linking Tema Port with Ashaiman Interchange on the Motorway) planned by Ghana Ports and Harbour Authority (GPHA) and to be implemented by the Department of Urban Roads (DUR) is in limbo as of May, 2019 for reasons unknown. Expansion of the Motorway from 4-lane to 6-lane under Public-Private-Partnership (PPP) is also stagnant due to delay in selection of procurement expert. Therefore, the approach roads have been planned to meet with the existing roads within the construction limits of Phase-1.

(4) Level of Service

The basic technical conditions of this project as indicated in the Technical Notes (Technical Memorandum) dated May 20, 2015 and December 18, 2015 were agreed with GHA during Phase-1 preparatory survey.

The condition agreed upon with regards to the Level of Service (LOS) of each major leg of the intersection was to attain a level of ‘C’ or higher. Since traffic concentrates during the morning and evening peak time, the LOS generally becomes low. Securing a high LOS at the peak time is therefore considered to be an excessive design. Therefore, the LOS of ‘D’ is planned to be attained for these roads.

On the other hand, the future traffic volume that is the basis for the intersection improvement plan is estimated on the assumption that there will be no development of the road network near the Tema intersection until 2035. This means that there is no change in traffic flow pattern (improvement of LOS by traffic change).

LOS is defined in accordance with traffic conditions such as travel speed, travel time, traffic obstruction, and comfort. LOS with respect to the general operating conditions is as shown in Table 2.2-2.

Table 2.2-2 Level of Service

Level of Service	General Operating Conditions
A	Free flow
B	Reasonable free flow
C	Stable flow
D	Approaching unstable flow
E	Unstable flow
F	Forced or breakdown flow

Source: Highway Capacity Manual

2.2.2 Basic Plan

2.2.2.1 Engineering Surveys

(1) Traffic Survey

1) Basic Policy

The configuration and structures of Phase-2 were planned based on the results of traffic demand forecast from the results of the traffic count survey carried out during Phase-1. Therefore, basic principal with regards to traffic forecast for Phase-2 follows the results of Phase-1. However, supplementary traffic count survey is carried out for verification of the traffic volume forecasted in Phase-1. Possible detours are included in the target locations of the survey to capture the vehicles that would use these detours to avoid the impacts of the ongoing Phase-1 construction area. The results would be compared and should significant difference be admitted, the demand forecast of Phase-1 will be re-analyzed.

With regards to the Ashaiman Roundabout, a traffic survey is conducted to understand the traffic behavior and issues. The Team study the possible remedial measures to mitigate the traffic congestion in and around the roundabout and share it with GHA for its reference.

2) Traffic Count at Tema Intersection

[Outline of the Survey]

The traffic count survey was conducted from January 26 to February 22, 2019. Survey locations, which included objective and the detours are as shown in Figure 2.2-1. Seven items as shown in Table 2.2-3 were surveyed.

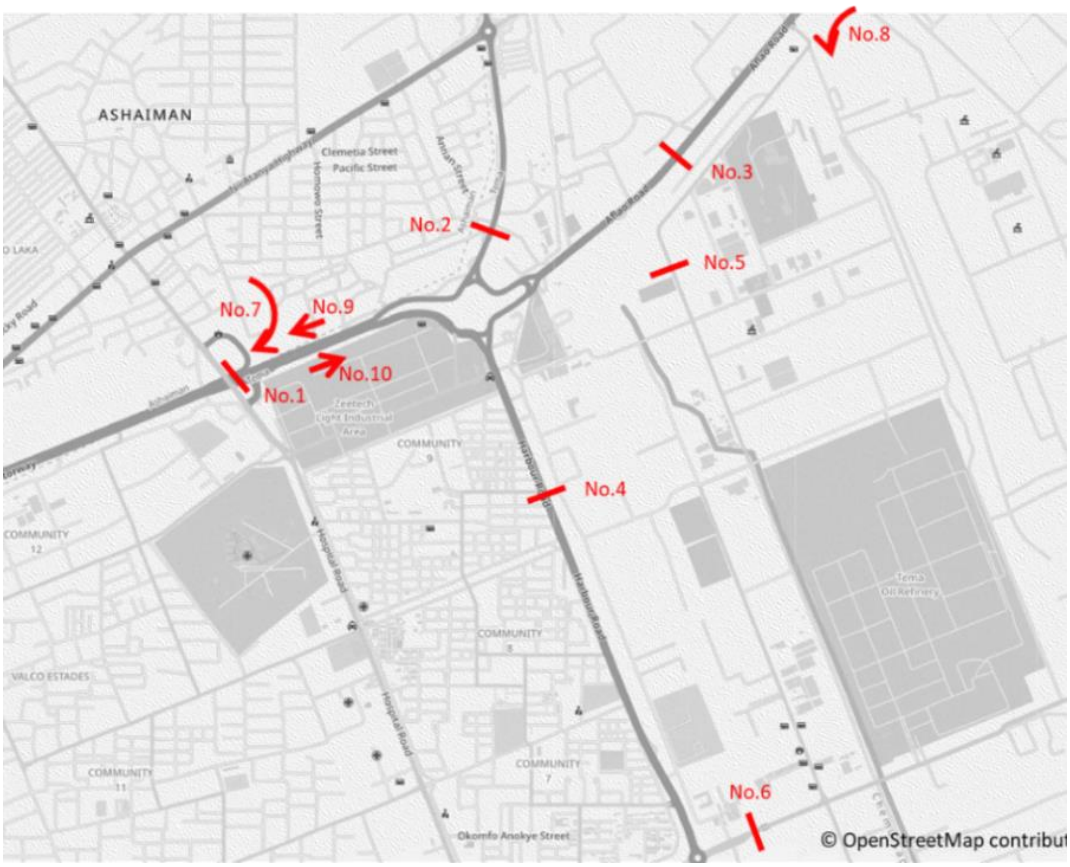


Figure 2.2-1 Survey Locations in and around Tema Intersection

Table 2.2-3 Traffic Count Survey at Tema Intersection

Survey Items		Survey Date	Location	Contents
Basic	1. Traffic count	Saturday, 26 January	No.1-4	Peak 3 hours
	2. Traffic count	Tuesday, 29 January	No.1-4	Peak 3 hours
Supplementary	3. Traffic count (detour)	Friday, 8 February	No.5,6	Evening peak 1 hour
	4. Traffic (Toll booth)	Friday, 15 February	No.7	Morning peak 1 hour
	5. OD Survey (simple)	Friday, 15 February	No.8	Evening peak 1 hour
	6. Traffic count	Thursday, 21 February	No.9	Same as above
	7. Traffic count	Friday, 22 February	No.10	Same as above

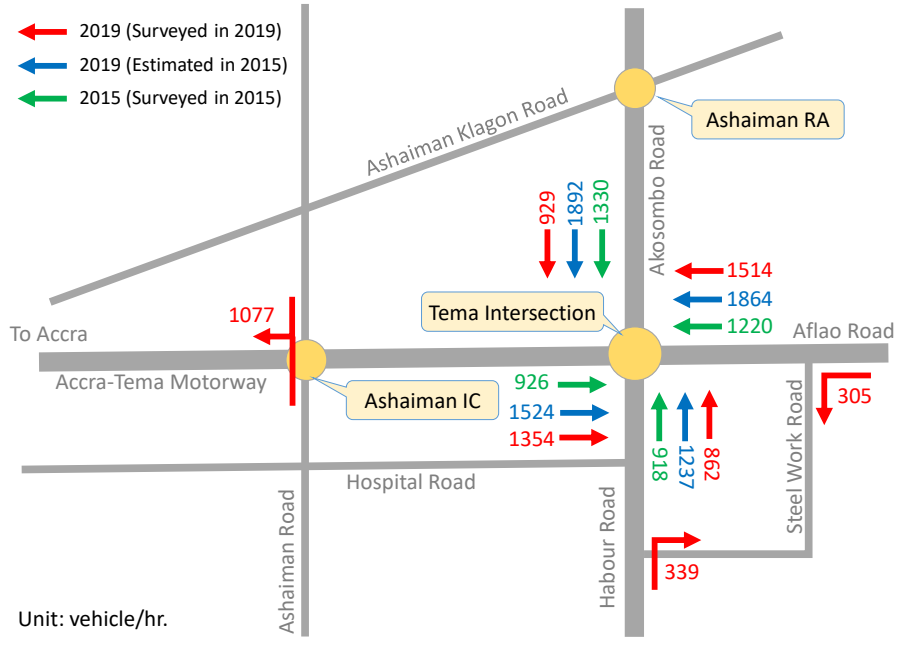
The classification of vehicles in the survey was done in accordance with the GHA pavement design manual. In this survey, the vehicle types were classified into eight (8) types, as shown in Table 2.2-4.

Table 2.2-4 Vehicle Classification (GHA Pavement Design Manual)

Classification of vehicles in the survey	GHA classification of vehicles
1. Motor Cycle	Motor bike
2. Passenger Car	Car
	Taxi
	Pick-up/Van/4WD vehicle
3. Minibus	Small bus
4. Bus	Medium bus/Mammy wagon
	Large bus
5. Light Truck	Light truck
6. Heavy Truck	Medium truck
	Heavy truck
7. Trailer	Semi-trailer (Light, Heavy)
	Truck-trailer
8. Others	Extra-large truck & others

[Results of Traffic Survey on Road Sections (Tema Roundabout)]

Figure 2.2-2 shows the actual measured values at the time of Phase-1 (2015), the estimated values for 2019, and the results of this traffic survey. Comparison and analysis with the measured and estimated values during Phase-1 is described in Section 4) "Phase-1 Traffic Analysis and Verification" hereunder.



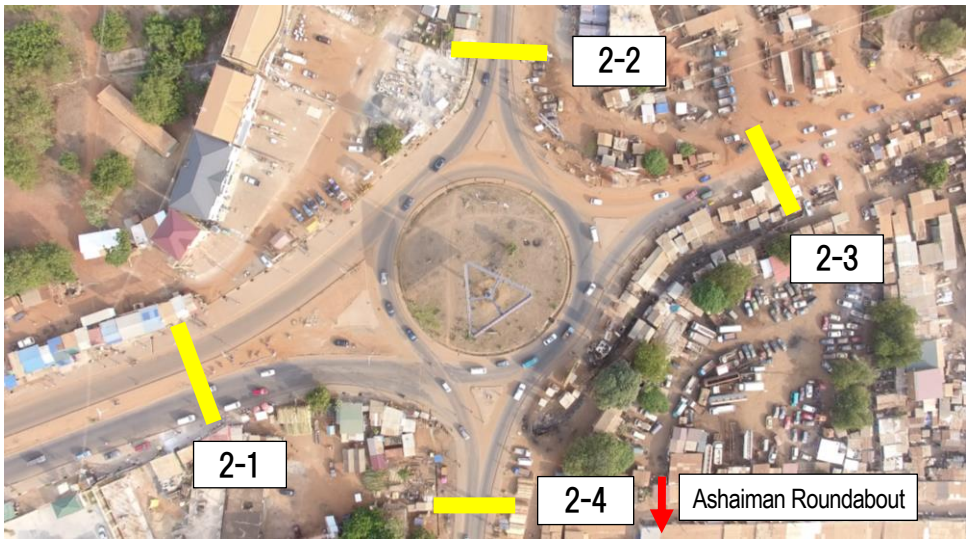
Source : JICA Survey Team

Figure 2.2-2 Results of Traffic Volume Survey on Road Sections

3) Results of Traffic Survey on Road Sections (Ashaiman Roundabout)

[Survey Overview]

Traffic survey by direction was conducted during peak hours on weekdays. The target route and survey points are shown in Figure 2.2-3. The number in the figure refers to each section number (Akosombo Road is defined as No. 2 at the Tema Roundabout, so the branch number of No. 2 is adopted).



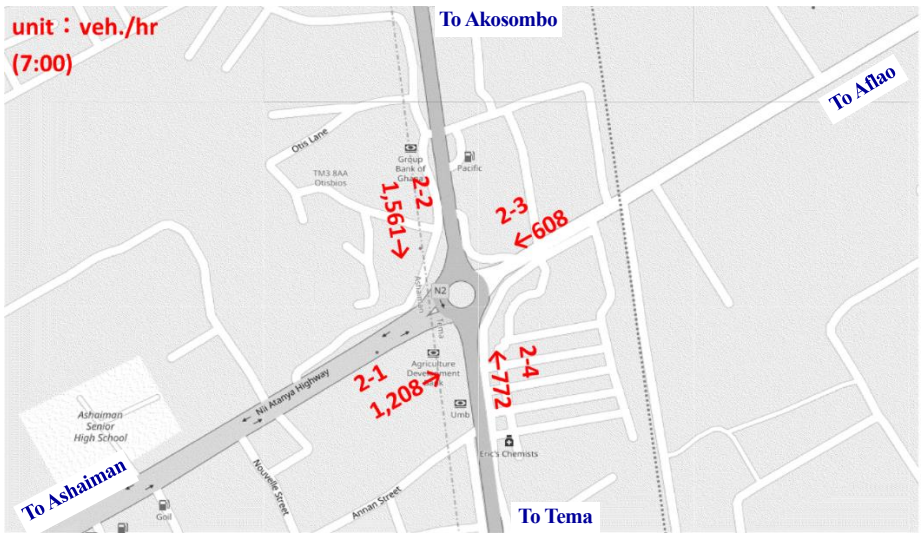
Source : JICA Survey Team

Figure 2.2-3 Survey Points (Ashaiman Roundabout)

A 15-minute traffic distribution pattern was recorded using a drone. Classification of the vehicles and the traffic volume for each direction was analyzed through an automatic analysis by counting the vehicles using artificial intelligence (AI). The 7 am peak hour traffic volume was then calculated/estimated by correlating the results from the AI and the Phase-1 survey.

[Results of Traffic Survey]

Figure 2.2-4 gives the traffic volume entering the Ashaiman Roundabout. Apparently, the volumes in the north-south direction is greater than those ply in the east-west direction, but the difference is not significant.



Source ：JICA Survey Team

Figure 2.2-4 Traffic Count Result (Inflow to Ashaiman Roundabout)

Volumes given in Table 2.2-5 are those passing the survey points (cross-sectional volume), while volumes provided in Table 2.2-6 are the number of traffics on each direction. The highest hourly traffic volume was at point 2-2 on the north leg, which was 2,547 vehicles per hour, followed by point 2-1 on the west leg with 2,472 per hour. Hourly volumes at point 2-4 on the south leg and point 2-3 on the east leg were 2,041 and 1,238 respectively.

The share of large-size vehicles is almost 2%, which is much lower than that of the Tema Roundabout.

Table 2.2-5 Results of traffic survey for each section

Classification	2-1 WEST		2-2 NORTH		2-3 EAST		2-4 SOUTH	
	Volume	%	Volume	%	Volume	%	Volume	%
Motorcycle	735	30%	748	29%	382	31%	577	28%
Car	1,313	53%	1,416	56%	707	57%	1,120	55%
Bus	6	0%	0	0%	0	0%	6	0%
Medium Vehicle	378	15%	328	13%	120	10%	288	14%
Heavy Vehicle	40	2%	55	2%	29	2%	50	2%
Total(All type of Veh.)	2,472	100%	2,547	100%	1,238	100%	2,041	100%
Share of Large size Veh.	46	2%	55	2%	29	2%	56	3%
Share of Large size truck	40	2%	55	2%	29	2%	50	2%
Total PCU	2,570	-	2,612	-	1,226	-	2,148	-

Source ：JICA Survey Team

Table 2.2-6 Results of Traffic Survey by direction

All Veh.	2−1	2−2	2−3	2−4	total
2−1	50	487	435	236	1,208
2−2	599	3	91	868	1,561
2−3	372	65	6	165	608
2−4	243	431	98	0	772
total	1,264	986	630	1,269	4,149

Source ：JICA Survey Team

4) Analysis and Verification of Phase-1 Traffic Volumes

Table 2.2-7 shows the results of the traffic count survey for each leg of the roundabout conducted on Saturday and Tuesday. The ratio of total number of traffic volumes of weekday to weekend (Tuesday / Saturday) 1.3, meaning the traffic volume on Tuesday is 1.3 times than that of Saturday. Phase-1 defines 7:00am of a weekday as the peak hour. Therefore, peak hour in Phase-2 was also defined on Tuesday and the survey results observed on the morning of this day is applied in the analysis.

Table 2.2-7 Comparison of peak traffic volume for each section between Saturday and Tuesday

Saturday,26/January

Classification	No.1 Accra-Tema MotorWay	No.2 Tema-Akosombo Road	No.3 Tema-Aflao Road	No.4 Tema Harbor Road
	Volume	Volume	Volume	Volume
Motorcycle	68	158	287	161
Car & Taxi	1,870	604	1,420	1,198
Minibus	409	545	526	727
Bus	46	13	131	82
Light Truck	101	34	80	41
Heavy Truck	88	26	55	51
Trailer	38	22	23	44
Others	2	7	36	20
Total(All type of Veh.)	2,622	1,409	2,558	2,324

Tuesday,29/January

Classification	No.1 Accra-Tema MotorWay	No.2 Tema-Akosombo Road	No.3 Tema-Aflao Road	No.4 Tema Harbor Road
	Volume	Volume	Volume	Volume
Motorcycle	109	329	237	231
Car & Taxi	2,142	749	1,947	1,588
Minibus	612	348	650	1,011
Bus	145	71	47	56
Light Truck	80	94	54	60
Heavy Truck	72	43	52	61
Trailer	41	60	36	55
Others	0	0	8	4
Total(All type of Veh.)	3,201	1,694	3,031	3,066

Tuesday/Saturday

Classification	No.1 Accra-Tema MotorWay	No.2 Tema-Akosombo Road	No.3 Tema-Aflao Road	No.4 Tema Harbor Road
	Volume	Volume	Volume	Volume
Motorcycle	1.6	2.1	0.8	1.4
Car & Taxi	1.1	1.2	1.4	1.3
Minibus	1.5	0.6	1.2	1.4
Bus	3.2	5.5	0.4	0.7
Light Truck	0.8	2.8	0.7	1.5
Heavy Truck	0.8	1.7	0.9	1.2
Trailer	1.1	2.7	1.6	1.3
Others	0.0	0.0	0.2	0.2
Total(All type of Veh.)	1.2	1.2	1.2	1.3

Source : JICA Survey Team

Table 2.2-8 shows the results of the road section traffic survey for each leg of the roundabout at peak time from 7:00am to 8:00am. The highest traffic volume was on point No. 1 on the Accra-Tema Motorway with 3,201 vehicles per hour, followed by point No.4 on the Tema Horbour Road with 3,066 vehicles per hour. Traffic volume on point No.3 on the Tema-Aflao Road and point No.2 on Tema-Akosombo Road was 3,031 and 1,694 vehicles per hour respectively.

Looking at the composition of vehicle types, the highest proportion of large size vehicle was on Tema-

Akosombo Road at 10%. Proportion on other points were less than 10%.

Table 2.2-8 Peak traffic volume for each section

Classification	No.1 Accra-Tema MotorWay		No.2 Tema-Akosombo Road		No.3 Tema-Aflao Road		No.4 Tema Harbor Road	
	Volume	%	Volume	%	Volume	%	Volume	%
Motorcycle	109	3%	329	19%	237	8%	231	8%
Car & Taxi	2,142	67%	749	44%	1,947	64%	1,588	52%
Minibus	612	19%	348	21%	650	21%	1,011	33%
Bus	145	5%	71	4%	47	2%	56	2%
Light Truck	80	2%	94	6%	54	2%	60	2%
Heavy Truck	72	2%	43	3%	52	2%	61	2%
Trailer	41	1%	60	4%	36	1%	55	2%
Others	0	0%	0	0%	8	0%	4	0%
Total(All type of Veh.)	3,201	100%	1,694	100%	3,031	100%	3,066	100%
Share of Large size Veh.	258	8%	174	10%	143	5%	176	6%
Share of Large size truck	113	4%	103	6%	96	3%	120	4%
Total PCU	3,447	-	1,765	-	3,101	-	3,187	-

Source : JICA Survey Team

Table 2.2-9 shows the comparison of Phase-1 and Phase-2 traffic volume. Traffic volumes of Phase-1 are the forecasted figures for 2019, while traffic volumes of Phase-2 are actual traffic volume counted in this Survey. As shown in the table, the total traffic volume counted during Phase-2 is higher at point No. 1 on the Motorway, while it is smaller at point No.2 on Akosombo Road. The volumes at point No. 3 on Aflao Road and point No.4 on Harbour Road are almost similar to the volumes forecasted for 2019. In terms of total volume, traffic volume counted in Phase-2 is approx. 20% less than the volume estimated for 2019 in Phase-1. This is assumed to be the effect of the vehicles that use the detours without passing through the intersection anticipating congestion at the intersection due to ongoing construction activities.

Table 2.2-9 Comparison of Traffic Volume between Phase-1 and Phase-2

Survey Station	Road Name	Peak time(7:00～8:00)											
		Phase1						Phase2			Phase2/ Phase1(2019estimation)		
		Tuesday, 14/April/ 2015			2019 estimation			Tuesday, 29/January/ 2019					
		Entry	Exit	Total	Entry	Exit	Total	Entry	Exit	Total	Entry	Exit	Total
No.1	Accra-Tema MotorWay	926	894	1,820	1,524	1,245	2,769	1,354	1,847	3,201	0.9	1.5	1.2
No.2	Tema-Akosombo Road	1,330	738	2,068	1,891	1,211	3,102	929	765	1,694	0.5	0.6	0.5
No.3	Tema-Aflao Road	1,220	1,091	2,311	1,864	1,714	3,578	1,514	1,517	3,031	0.8	0.9	0.8
No.4	Tema Harbor Road	918	1,663	2,581	1,237	2,361	3,598	862	2,204	3,066	0.7	0.9	0.9
No.5	Tema-Hospital Road	469	404	873	607	592	1,199	–	–	–	–	–	–
Total		4,863	4,790	9,653	7,123	7,123	14,246	4,659	6,333	10,992	0.7	0.9	0.8

Source : JICA Survey Team

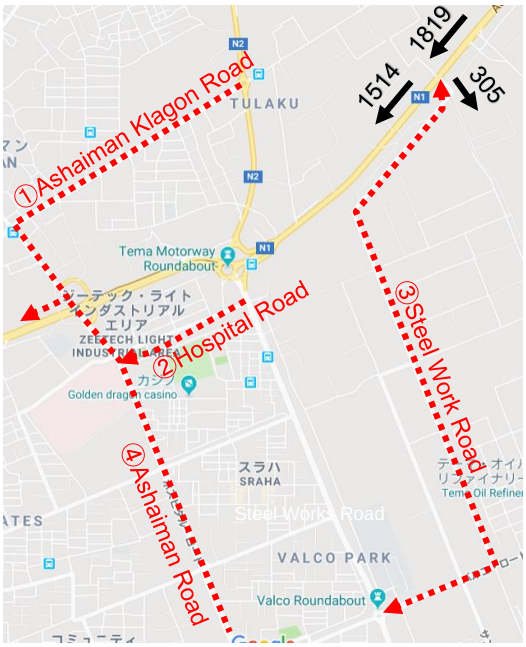
- The following four roads are detours at the Tema Roundabout.

  (1)Ashaiman Klagon Road
  (2)Hospital Road
  (3)Steel Work Road
  (4)Ashaiman Road

- About 17% of the inflow traffic from Aflao Road to Tema Roundabout converts to Steel Work Road.

- OD survey results indicates about 90% or more of the traffic on the above Steel Work Road is heading toward Harbor Road (Not internal traffic) .

- Steel Work Road is currently under construction, and some have already been paved. According to the administrator's of DUR, it will be completed in 2019 and may operate in the future as well.



Serviced section

Under construction

Source : JICA Survey Team

Figure 2.2-5 Verification Results of Existing Traffic Characteristics

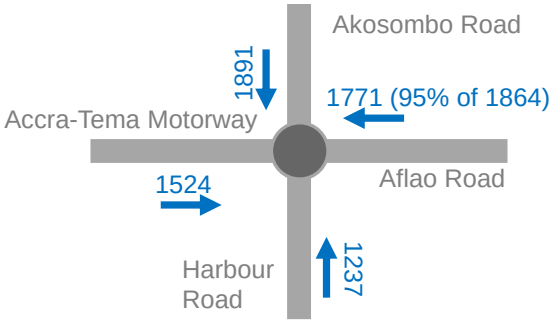
5) Verification Results and Review of Phase-1 Traffic Volume

Based on the above analysis and verification results, Phase-1 traffic volume in Aflao Road was reviewed in Phase-2, and used for input for demand forecast. The review outline and result are shown in Figure 2.2-6.

- Compared to the values of 2019 estimated during Phase-1, the current cross-sectional traffic volume was confirmed to be decreasing. This is thought due to traffic detours to avoid construction congestion.

- However, when the surrounding traffic and the traffic on the detour is viewed from a wide perspective, the traffic volumes counted are almost the same as the ones estimated in Phase-1 for 2019. Therefore, the estimated value in Phase-1 can be considered to be appropriate.

- As of February 2019, about 17% of traffic volume has diverted from Aflao Road to Steel Work Road, which is currently under construction.
- Steel Work Road is expected to function as a bypass of Aflao Road and Harbor Road even after the completion of this project, but since the Tema Intersection may receive traffics on these detours after completion of the project, the current traffic volume at the Tema Intersection is sets as follows.



  - ➢ 5% of the traffic from the estimated traffic volume during Phase-1 is expected to divert to the Steel Work Road and only 95% will ply along the Aflao Road and the intersection.
  - ➢ Traffic volume on all other legs of the intersections will be similar to the volume estimated during Phase-1.

Source : JICA Survey Team

Figure 2.2-6 Review of Phase-1 traffic volume

Consequently, the traffic volumes to be applied for the demand forecast is as given in Table 2.2-10.

Table 2.2-10 Setting of current traffic volume (2019)

Survey Section	Road Name	Peak time (7:00-8:00)					
		Phase-1 Survey			Phase-2 Survey		
		2019 Estimation			2019 Setting		
		Entry	Exit	Total	Entry	Exit	Total
No.1	Accra-Tema motorway	1,524	1,245	2,769	1,524	1,224	2,748
No.2	Tema-Akosombo Road	1,891	1,211	3,102	1,891	1,204	3,095
No.3	Tema-Aflao Road	1,864	1,714	3,578	1,771	1,713	3,484
No.4	Tema Harbor Road	1,237	2,361	3,598	1,844	2,889	4,733
No.5	Tema Hospital Road	607	592	1,199	-	-	-
Total		7,123	7,123	14,246	7,030	7,030	14,060

*1,771＝1,864×95%

(2) Traffic Demand Forecast

1) Basic consideration

In Phase-1, the future traffic demand forecast was calculated as the product of the current traffic volume and the rate of future traffic growth. The demand forecast model that defines the Accra Motorway's toll revenue as the explanatory variable was applied to calculate the rate of traffic growth. The population growth rate of Tema Metropolitan, the growth rate of freights handled at Tema Port were taken as the explanatory variable and the growth rate of the toll revenue was calculated using the demand forecast model. This value was applied for the traffic growth rate

Since new findings regarding the populations and cargo handling volume of Tema Port were not available,

the demand forecast model of Phase-1 was applied.

2) Socio-economic Framework

In calculating the future traffic demand, first, the socioeconomic framework was set based on the available data. The set framework included the local population, and the volume of cargo handled at Tema Port. The concept of calculation of each indicator is as follows.

[Population]

The population framework was set using the population of the Greater Accra Region, excluding the Ga West District. This judgement came from the traffic volume at the Tema Roundabout with a high correlation with this region. The values for the framework are shown in Table 2.2-11.

Table 2.2-11 Population frame around Tema Roundabout

Year	Accra Metropolitan	Tema	Dangme West	Dangme East	Total
2000	1,658,937	506,400	96,809	93,112	2,355,258
2010	2,076,546	671,824	122,836	130,795	3,002,001
2011	2,142,129	693,042	126,716	134,926	3,096,813
2012	2,209,784	714,930	130,718	139,187	3,194,619
2013	2,279,575	737,510	134,846	143,583	3,295,514
2014	2,351,571	760,803	139,105	148,118	3,399,597
2015	2,425,841	784,831	143,498	152,796	3,506,966
2020	2,728,839	902,985	210,846	204,475	4,047,145
2025	3,011,449	1,024,140	309,802	273,634	4,619,025
2030	3,262,379	1,148,298	455,200	366,184	5,232,061
2035	3,447,302	1,272,783	668,839	490,037	5,878,961

Source : JICA Survey Team based on population sensus in Ghana

[Cargo Volume at Tema Port]

The central predicted values from the Ghana Master Ports Development Plan -Cargo Forecast- were adopted for the volumes of cargo that would handle at Tema Port in the future. Marine transshipment volume, which does not affect the land traffic, was excluded. On the other hand, dry bulk cargos, general cargos, container cargos, and liquid cargos were included. Table 2.2-12 shows the cargo volume handled in the future at the Tema Port.

Table 2.2-12 Tema Port Cargo Volume

Year	Volume Handled (×1000 tonne)
2010	8,460
2011	10,578
2012	11,419
2013	12,129
2014	15,370
2015	18,610
2020	26,350
2025	35,480
2030	44,800
2035	55,130

Source : Static data and Forecast by GPHA

3) Formulation of Demand Forecast Model

In calculating the growth rate in the traffic volume, first, a demand forecast model was built for two types of vehicles using the toll revenue of the Accra - Tema Motorway as an explained variable. The explanatory variables were the population of the Tema region, and the volume of cargos handled at Tema Port. From the demand prediction model, the percentage increase in the toll revenue was calculated, and this applied to the growth rate in the traffic volume. There were two types of prediction models, a passenger car model and a freight vehicle model. The model equation was a linear regression equation. The model parameters and the toll revenue of the Accra - Tema Motorway are shown in Table 2.2-13 and Table 2.2-14. Either model was high in a coefficient of determination, so the applicability was good.

Table 2.2-13 Model Parameters

Passenger car model	Coefficient (population)	Constant term (x1000)	Determination Coefficient
	14.60	-35581	0.99
Goods vehicle model	Coefficient (population)	Constant term (x1000)	Determination Coefficient
	1.10	-1365	0.90

Source : JICA Survey Team

Table 2.2-14 Toll revenue of Accra - Tema Motorway

Year	Revenue of Toll Gate (1000 Cedi)
2010	8,300
2011	9,600
2012	11,000
2013	12,600
2014	14,400

Source : Ghana Road Fund

4) Estimated Traffic Growth Rate

The future toll revenue was estimated based on the model prepared in the previous section. The average annual percentage increase for every five years obtained from the estimated results are shown in Table 2.2-15. The light truck values are average values of passenger cars and heavy trucks because light trucks have characteristics of intermediate of the two.

Table 2.2-15 Estimated results

Period of growth rate	Passengers cars	Light trucks	Heavy trucks
2019-2020	8.52%	8.08%	7.65%
2020-2025	6.27%	6.33%	6.40%
2025-2030	5.08%	5.00%	4.93%
2030-2035	4.25%	4.30%	4.35%

Source : JICA Survey Team

5) Results of Traffic Demand Forecast

Future traffic demand was calculated by multiplying the 2019 traffic volume reviewed in Section 2.2.2.1 by

the rate of future traffic growth. The estimated traffic volume by peak direction in each year is shown in Table 2.2-16 and Table 2.2-17. The numbers in 1st row and 1st column in each table indicate the section numbers shown in Figure 2.2-7.

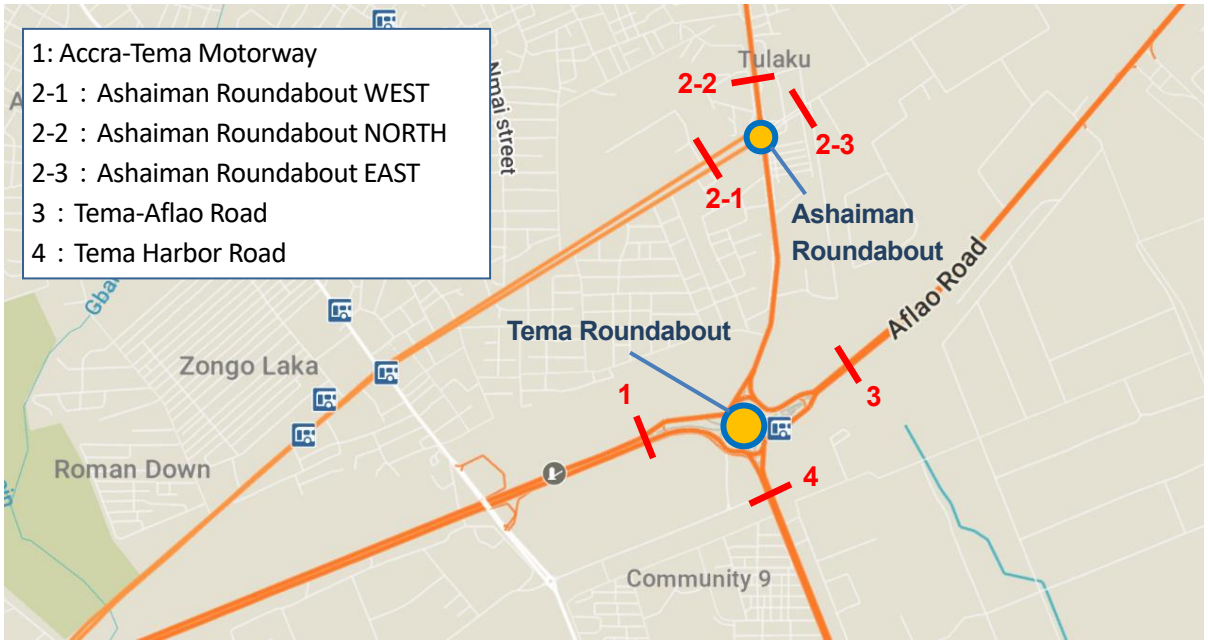


Figure 2.2-7 Location of the section number in Table 2.2-16 and Table 2.2-17

Table 2.2-16 Traffic Volume according to Direction at Peak Hours in 2025(Veh./hr)

2025 Veh./hr

MOTOR	1	2-1	2-2	2-3	3	4	Total
1	4	4	16	4	46	94	168
2-1	32	22	211	262	4	44	575
2-2	90	236	3	35	18	126	508
2-3	7	131	40	3	1	14	196
3	20	3	14	3	13	50	103
4	37	18	56	18	77	3	209
Total	190	414	340	325	159	331	1,759
CAR	1	2-1	2-2	2-3	3	4	Total
1	17	68	166	26	597	363	1,237
2-1	64	38	327	324	36	154	943
2-2	310	537	0	70	170	749	1,836
2-3	74	361	40	3	40	177	695
3	286	40	100	17	17	1,305	1,765
4	134	126	309	50	806	128	1,553
Total	885	1,170	942	490	1,666	2,876	8,029
MINIBUS	1	2-1	2-2	2-3	3	4	Total
1	0	49	121	19	137	215	541
2-1	26	1	5	0	7	20	59
2-2	128	2	0	2	44	103	279
2-3	32	1	7	0	13	22	75
3	136	5	19	2	1	306	469
4	109	84	204	35	235	30	697
Total	431	142	356	58	437	696	2,120
LARGEBUS	1	2-1	2-2	2-3	3	4	Total
1	0	3	0	0	1	3	7
2-1	7	4	0	0	7	13	31
2-2	0	0	0	0	0	0	0
2-3	0	0	0	0	0	0	0
3	1	0	0	0	0	7	8
4	3	13	0	0	2	0	18
Total	11	20	0	0	10	23	64
LIGHTTRUCK	1	2-1	2-2	2-3	3	4	Total
1	14	5	2	1	49	32	103
2-1	13	0	0	0	1	3	17
2-2	28	0	0	0	2	13	43
2-3	5	0	0	0	1	2	8
3	53	2	1	0	0	37	93
4	34	14	4	1	40	3	96
Total	147	21	7	2	93	90	360
TRUCK	1	2-1	2-2	2-3	3	4	Total
1	1	14	3	2	32	19	71
2-1	3	14	165	32	3	13	230
2-2	16	101	0	30	14	32	193
2-3	2	43	15	0	2	5	67
3	35	1	0	0	1	24	61
4	17	4	1	1	35	14	72
Total	74	177	184	65	87	107	694
TRAILER	1	2-1	2-2	2-3	3	4	Total
1	0	0	3	1	4	5	13
2-1	1	0	14	22	0	1	38
2-2	4	5	0	0	0	3	12
2-3	0	14	0	0	0	0	14
3	30	0	13	1	0	19	63
4	5	0	6	1	21	0	33
Total	40	19	36	25	25	28	173
OTHERS	1	2-1	2-2	2-3	3	4	Total
1	0	0	0	0	26	63	89
2-1	0	0	0	0	0	0	0
2-2	0	0	0	0	1	2	3
2-3	0	0	0	0	0	0	0
3	16	0	0	0	0	23	39
4	0	0	16	2	13	1	32
Total	16	0	16	2	40	89	163
All veh.	1	2-1	2-2	2-3	3	4	Total
1	36	143	311	53	892	794	2,229
2-1	146	79	722	640	58	248	1,893
2-2	576	881	3	137	249	1,028	2,874
2-3	120	550	102	6	57	220	1,055
3	577	51	147	23	32	1,771	2,601
4	339	259	596	108	1,229	179	2,710
Total	1,794	1,963	1,881	967	2,517	4,240	13,362

Table 2.2-17 Traffic Volume according to Direction at Peak Hours in 2035(Veh./hr)

2035 Veh./hr

MOTOR	1	2-1	2-2	2-3	3	4	Total
1	4	4	26	4	74	149	261
2-1	52	32	332	412	4	69	901
2-2	143	373	3	55	28	198	800
2-3	7	206	60	3	1	24	301
3	30	3	24	3	23	80	163
4	57	28	87	28	122	3	325
Total	293	646	532	505	252	523	2,751
CAR	1	2-1	2-2	2-3	3	4	Total
1	27	107	261	38	940	570	1,943
2-1	101	58	515	510	56	244	1,484
2-2	489	847	0	111	270	1,181	2,898
2-3	117	567	60	3	60	278	1,085
3	452	60	157	27	27	2,059	2,782
4	212	198	488	80	1,272	202	2,452
Total	1,398	1,837	1,481	769	2,625	4,534	12,644
MINIBUS	1	2-1	2-2	2-3	3	4	Total
1	0	78	190	29	215	339	851
2-1	38	1	5	0	7	30	81
2-2	202	2	0	2	69	162	437
2-3	52	1	7	0	23	32	115
3	214	5	29	2	1	483	734
4	172	132	322	55	372	50	1,103
Total	678	219	553	88	687	1,096	3,321
LARGEBUS	1	2-1	2-2	2-3	3	4	Total
1	0	3	0	0	1	3	7
2-1	7	4	0	0	7	23	41
2-2	0	0	0	0	0	0	0
2-3	0	0	0	0	0	0	0
3	1	0	0	0	0	7	8
4	3	23	0	0	2	0	28
Total	11	30	0	0	10	33	84
LIGHTTRUCK	1	2-1	43,863	2-3	3	4	Total
1	24	5	2	1	78	52	162
2-1	23	0	0	0	1	3	27
2-2	46	0	0	0	2	23	71
2-3	5	0	0	0	1	2	8
3	83	2	1	0	0	57	143
4	54	24	4	1	60	3	146
Total	235	31	7	2	142	140	557
TRUCK	1	2-1	2-2	2-3	3	4	Total
1	1	24	3	2	52	29	111
2-1	3	24	260	52	3	23	365
2-2	26	159	0	49	24	52	310
2-3	2	67	25	0	2	5	101
3	55	1	0	0	1	34	91
4	27	4	1	1	55	24	112
Total	114	279	289	104	137	167	1,090
TRAILER	1	2-1	2-2	2-3	3	4	Total
1	0	0	3	1	4	5	13
2-1	1	0	24	32	0	1	58
2-2	4	5	0	0	0	3	12
2-3	0	24	0	0	0	0	24
3	49	0	23	1	0	29	102
4	5	0	6	1	31	0	43
Total	59	29	56	35	35	38	252
OTHERS	1	2-1	2-2	2-3	3	4	Total
1	0	0	0	0	37	99	136
2-1	0	0	0	0	0	0	0
2-2	0	0	0	0	1	2	3
2-3	0	0	0	0	0	0	0
3	26	0	0	0	0	33	59
4	0	0	26	2	23	1	52
Total	26	0	26	2	61	135	250
All veh.	1	2-1	2-2	2-3	3	4	Total
1	56	221	485	75	1,401	1,246	3,484
2-1	225	119	1,136	1,006	78	393	2,957
2-2	910	1,386	3	217	394	1,621	4,531
2-3	183	865	152	6	87	341	1,634
3	910	71	234	33	52	2,782	4,082
4	530	409	934	168	1,937	283	4,261
Total	2,814	3,071	2,944	1,505	3,949	6,666	20,949

Source : JICA Survey Team

(3) Geo-technical Investigation

1) Objectives

The objectives of the investigations were;

- To provide specific site information to confirm and amplify the geotechnical and geomorphologic findings of the desk study;
- To obtain detailed knowledge of the soils to be encountered at the site and their likely behavior on substructures ;
- To foresee and provide against difficulties and delays that may arise during construction due to groundwater and other local conditions;
- To establish design parameters and present basis for the design of substructures.

2) Scope of Investigation

The investigation consists of field work and laboratory work. The scopes of each work are shown in Table 2.2-18.

Table 2.2-18 Investigation Items and Scopes

Items	Scopes (works performed)
1. Geotechnical	1. Exploratory borings with standard penetration tests, sampling and confirmation of natural ground water level, 2. Laboratory soil tests on samples collected from boreholes, 3. CBR tests at the existing road and the planed road, and 4. Dynamic Cone Penetration test
2. Material	1. Laboratory tests on soil samples, and 2. Laboratory tests on aggregate samples

3) Investigation Period

The investigation works were carried out from end of January 2019 till end of March 2019.

4) Investigation Results

[Geo-technical Investigation]

The approach adopted for the geotechnical investigation consisted of:

- Desk study and field reconnaissance (geological and geotechnical information on the project area)
- Drilling and sample extraction
- Laboratory testings

The ground investigation was undertaken in accordance with the ASTM D220. For drilling and sample extraction, five (5) boreholes were drilled at the site. The location of the boreholes is presented in Figure 2.2-8. In-situ Standard Penetration Test (SPT) was carried out at every 1 m interval up until refusal was recorded.

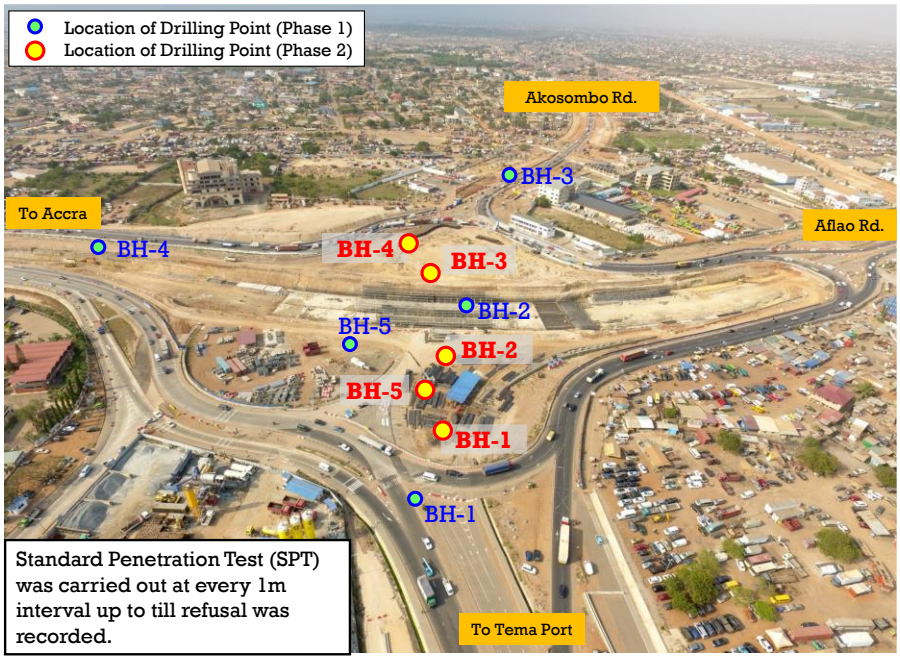


Figure 2.2-8 Location of Drilling Points and CBR Test

[Laboratory Testing]

The disturbed and SPT samples recovered from the boreholes have been tested at the laboratory for the following items;

- Moisture/water content(ASTM D2216)
- Unit weight (ASTM C29)
- Specific gravity (ASTM D854)
- Grading/Sieve analysis (sieving + Hydrometer test, ASTM D422)
- Liquid and plastic limits (ASTM D431)

[Results and Observations]

The composition of the ground, soil distribution layer and its N-value and soil properties for all five (5) locations where drilling was conducted are summarized in Table 2.2-19. Based on the results of drilling at five locations, the geological profile of the target flyover location is assumed as shown inTable 2.2-19 and Figure 2.2-9. The presence of weathered rocks with an N value of more than 50 was confirmed at G.L.-2 m to -5 m.

Table 2.2-19 Investigation Results

No.	Depth (m)	Layer Thickness (m)	Soil Properties	N-value (Nos.)	Remarks
BH1	2.0	2.0	Stiff, dry, greyish sandy **CLAY** with medium sized sandstone particles	10	
	5.0	3.0	Medium density, hard and slightly damp **SANDY SOIL** with a mixture of light brownish clay	18-25	
	6.0	1.0	Very hard and slightly moist, light brown **SANDY SILT**	19	
	7.0 and below	>5 m	Rock	>50	Refusal
BH2	2.0	2.0	Medium density, hard and slightly damp **CLAYISH GRAVEL** mixed with light brownish clay	29-50	
	6.0 and below	>4 m	Rock	>50	Refusal
BH3	3.0	3.0	Medium density, hard and slightly damp **SANDY SOIL** with a mixture of light brownish clay	18-25	
	4.0 and below	>5 m	Rock	>50	Refusal
BH4	1.0	1.0	Medium density, hard and slightly damp **SANDY SOIL** with a mixture of light brownish clay	24	
	2.0	1.0	Very hard and slightly moist, light brown **SANDY SILT**	43	
	3.0 and below	>5.0	Rock	>50	Refusal
BH5	5.0	5.0	Hard and slightly damp brown sand and gravel mixed **CLAY**	9-39	
	6.0 and below	>4 m	Rock	>50	Refusal

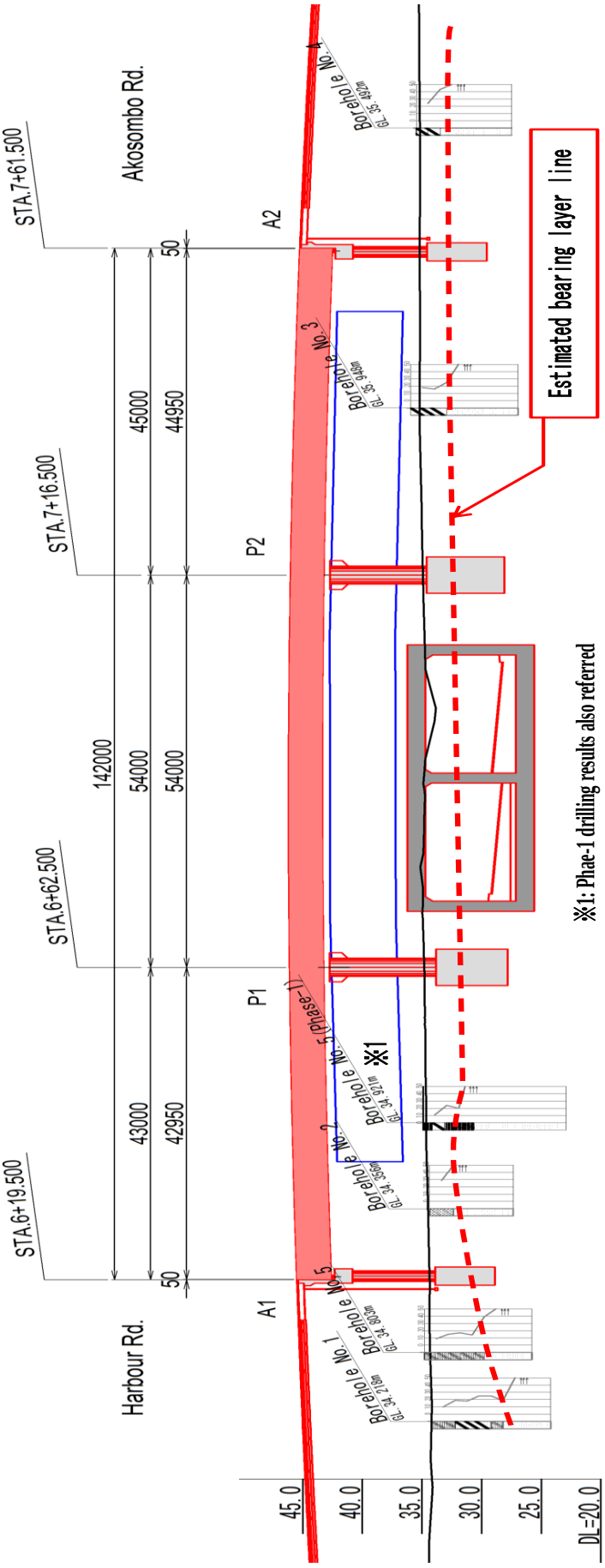


Figure 2.2-9 Geological Profile

(4) Material Investigation

Materials such as soil for fill and aggregates for concrete and asphalt are available locally and from the same sites of Phase-1. As these materials have already been tested during Phase-1, the results of Phase-1 are referred.

(5) Utility Survey

The Phase-1 construction has identified various utilities in the project area. Electrical poles and cables belonging to Electricity Company of Ghana (ECG), water pipes belonging to Ghana Water Company Limited (GWCL), telecommunication cables belonging to MTN, TIGO, AIRTEL, VODAFONE, GLO etc. Basically, all the utilities within the Phase-1 construction premises have been identified and relocated outside of Phase-1 construction limits. The area of Phase-2 construction lies within the premises of Phase-1, in the middle of Phase-1 area to be precise. As such, existence of utilities that would affect the construction of Phase-2 are not anticipated.

2.2.2.2 Review of Intersection Configuration

(1) Basic Policy

Phase-1 construction is already underway, and it is fundamentally important to ensure that the basic structures of phase-2 are in harmony with Phase-1. However, taking the decrease of traffic volume plying to Aflao-Tema direction, the demand foreast conducted during Phase-1 was reviewed. The capacity analysis of the intersection was re-done and as the construction of the intersection was yet to be undertaken as of May, 2019, the alteration of the configuration, if justifiable was agreed to be undertaken through design change in the Phase-1 construction.

(2) Target Road

The subject of examination is the number of lanes at the inflow of the intersection of Aflao Road. In Phase-1, 3 lanes were planned as exclusive left-turning lanes. However, taking the decrease of the traffic volume into consideration, capacity analysis of the intersection was re-checked.

(3) Condition

Following conditions are taken into consideration.

- As in Phase-1, the traffic volume by direction of peak hours as of 2035 is used as input.
- Analysis based on HCM2010
- LOS to be secured will be level ‘D’ or higher

(4) Analysis Results

Analysis result is shown in Table 2.2-20. It is evident from the result that LOS ‘D’ can still be secured even in case the number of inflow lanes (left-turn lanes) is reduced to 2-lanes (Figure 2.2-10).

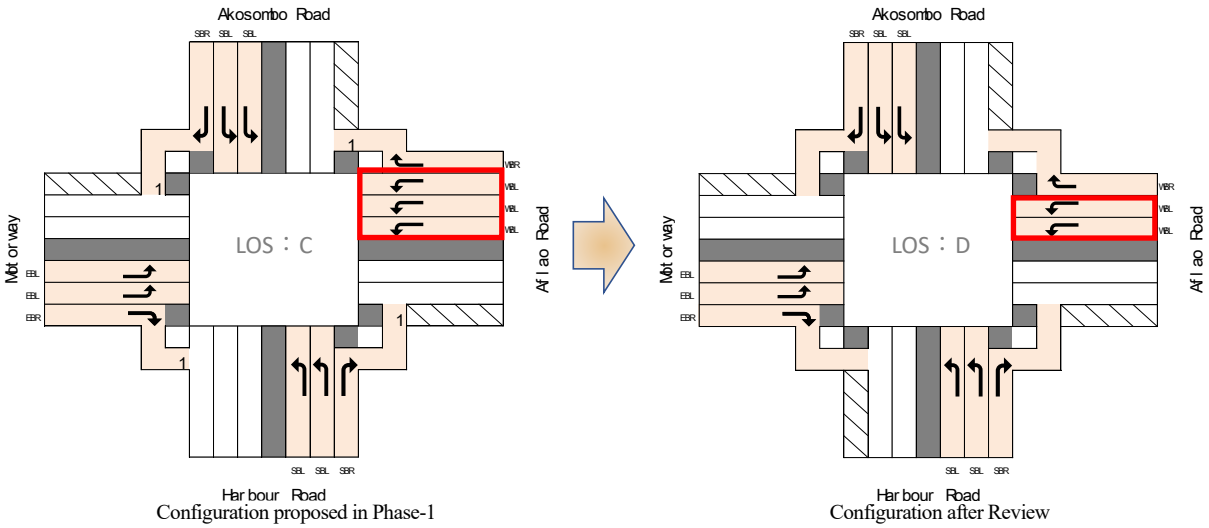
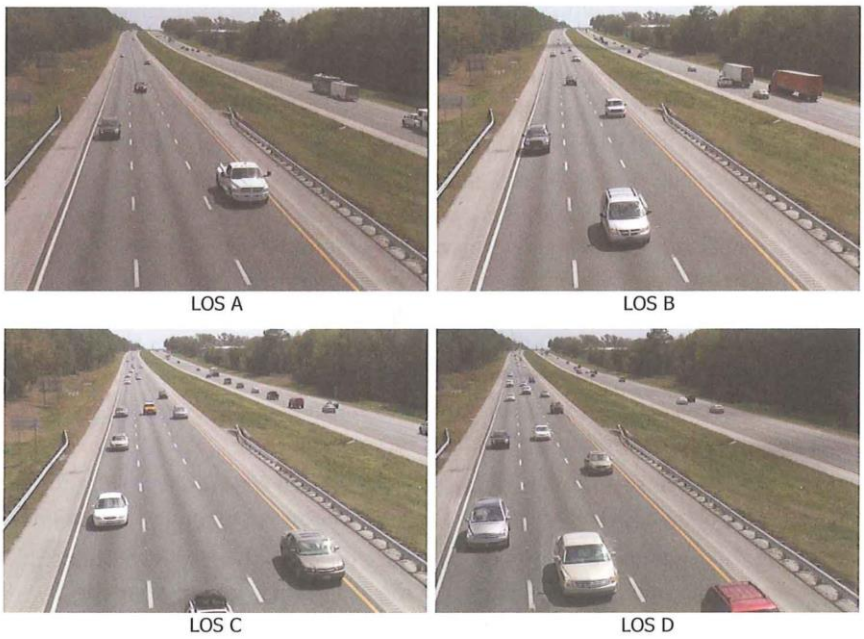


Figure 2.2-10 Review of Configuration (Inflow from Aflao Road)

The LOS derived from the analysis is the evaluation result for the traffic volume of 1 hour morning peak time of the day. In other words, the LOS is for the worst scenario and should it be calculated for the traffic situation for other hours, the LOS would certainly be higher than 'D'.

In a technical design review by GHA in May 2019, the change in the number of lanes was explained to GHA The consent was obtained and it was approved in September 2019 for design change to be reflected in Phase-1 construction.



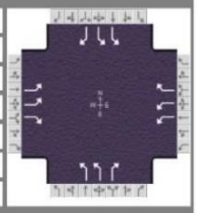
Source: Highway Capacity Manual, 2010

Figure 2.2-11 Pictures Showing Flow Condition for LOS A-D

Table 2.2-20 Analysis Result

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.25
Analyst		Analysis Date	7/2/2015	Area Type	Other
Jurisdiction		Time Period		PHF	0.98
Urban Street	Tema Motorway	Analysis Year	2015	Analysis Period	1> 7:00
Intersection	Tema Intersection	File Name	★Phase-2見直し後.xus		
Project Description	Case-04				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	805		0	2554		0	496		0	565		0

Signal Information													
Cycle, s	60.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	Off	Green	41.0	7.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	Off	Yellow	4.0	4.0	0.0	0.0	0.0	0.0			
				Red	2.0	2.0	0.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		6		2		4		8
Case Number		5.0		5.0		5.0		5.0
Phase Duration, s		47.0		47.0		13.0		13.0
Change Period, (*Y*+*R c*), s		6.0		6.0		6.0		6.0
Max Allow Headway (*MAH*), s		2.0		2.0		2.0		2.0
Queue Clearance Time (*g s*), s		14.0		43.0		9.0		9.0
Green Extension Time (*g e*), s		0.7		0.0		0.0		0.0
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.00		1.00		1.00		1.00

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1		16	5		12	7		14	3		18
Adjusted Flow Rate (*v*), veh/h	821		0	2606		0	506		0	577		0
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1675		1459	1689		1535	1647		1535	1647		1560
Queue Service Time (*g s*), s	12.0		0.0	41.0		0.0	7.0		0.0	7.0		0.0
Cycle Queue Clearance Time (*g c*), s	12.0		0.0	41.0		0.0	7.0		0.0	7.0		0.0
Green Ratio (*g/C*)	0.68		0.68	0.68		0.68	0.12		0.12	0.12		0.12
Capacity (*c*), veh/h	2529		997	2548		1049	624		179	624		182
Volume-to-Capacity Ratio (*X*)	0.325		0.000	1.023		0.000	0.811		0.000	0.923		0.000
Back of Queue (Q), ft/ln (95 th percentile)	239.5		0	987.1		0	209.6		0	265.6		0
Back of Queue (Q), veh/ln (95 th percentile)	9.1		0.0	38.0		0.0	7.9		0.0	10.0		0.0
Queue Storage Ratio (*RQ*) (95 th percentile)	0.24		0.00	0.99		0.00	0.21		0.00	0.27		0.00
Uniform Delay (*d 1*), s/veh	12.0		0.0	24.5		0.0	29.6		0.0	29.9		0.0
Incremental Delay (*d 2*), s/veh	0.0		0.0	23.9		0.0	7.4		0.0	19.2		0.0
Initial Queue Delay (*d 3*), s/veh	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Control Delay (*d*), s/veh	12.0		0.0	48.5		0.0	37.0		0.0	49.1		0.0
Level of Service (LOS)	B			F			D			D		
Approach Delay, s/veh / LOS	12.0		B	48.5		D	37.0		D	49.1		D
Intersection Delay, s/veh / LOS	40.6						D					

2.2.2.3 Flyover Plan

(1) Basic Policy

1) Flyover Location

The location and alignment of the flyover was planned in Phase-1 and the underpass including ramps and an at-grade intersections of Phase-1 were designed based on the outline design of the flyover. Review of the

bridge plan conducted in Phase-1 concludes that the plan is appropriate from traffic safety and economic point of view. For this reason and as changing the plan would incur impact on the road already constructed in Phase-1, the alignment and location of the bridge determined in Phase-1 is applied.

2) Technical Specifications

The following standards and codes will be applied.

- Guide for Bridge Design, Ghana, 1991
- BS 5400
- Specifications for Highway Bridges, Japan Road Association (JRA), March 2012

The bridge shall be designed in accordance with the Specification for Highway Bridges (JRA). However, design conditions such as carriageway width and design load shall be defined and examined, referring to Guide for Bridge Design and BS 5400 and discussions with GHA.

(2) Design Criteria

1) Pre-requisites

a. Ensure the vertical limit (H = 5.5 m) at the ramp
b. Design a curved bridge with R = 520 m
c. Vertical alignment of viaduct is 4.0% or less

2) Location of Substructure

The flyover abutments are positioned at locations that would have no impact to the ramps (left-turn). The bridge is planned to span over the box culvert and the at-grade intersection of Phase-1. Locating substructures within the at-grade intersection is also difficult as there is no suitable space for such provision.

3) Width of Carriageway

The Ghanaian Guide for Bridge Design requires provision of two-lane carriageway having a width of 8.5 m. The width of the flyover applied is as shown in Figure 2.2-12. This is determined with reference to the requirements and results of discussion with GHA.

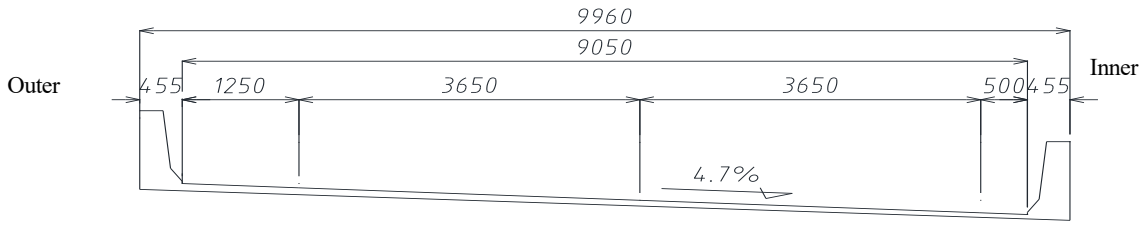


Figure 2.2-12 Cross Section of the Flyover

4) Loads

[Dead Load]

Dead load is calculated using the unit weight given in the Specifications for Highway Bridges (JRA) shown in Table 2.2-21.

Table 2.2-21 Unit Weight of Materials

Material	Unit weight (kN/m3)	Material	Unit weight (kN/m3)
Steel/ cast steel/ forged steel	77.0	Concrete	23.0
Cast iron	71.0	Cement mortar	21.0
Aluminum	27.5	Wood	8.0
Reinforced concrete	24.5	Pitch (for waterproofing)	11.0
Prestressed concrete	24.5	Asphalt pavement	22.5

Source: Specifications for Highway Bridges (JRA)

[Live Load]

GHA has requested that the design live load be defined according to BS5400, which is the basis of Ghana for Bridge Design. The BS5400 adopts the limit state design method, but the Specifications for Highway Bridges (JRA) use the allowable stress method, so it is unable to apply the design live load of BS 5400 straight to the allowable stress method. For this reason, the HA + 45HB vehicle load, the design live load of BS 5400 needs to be examined and compared with the B live load of the Specifications for Highway Bridges (JRA). Among them, the live load strength and conditions that have the most adverse effect will be employed.

HA Loading

HA loading consists of a uniformly distributed load (UDL) and a knife edge load (KEL) combined, including a dynamic effect of vehicle loading. The UDL is distributed on the linear meter of notional lane which determines the values of the load given in the loading curve illustrated in Figure 2.2-13. The KEL per notional lane is taken as 120 kN. The UDL and KEL are taken to occupy one notional lane, uniformly distributed over the full width of the lane.

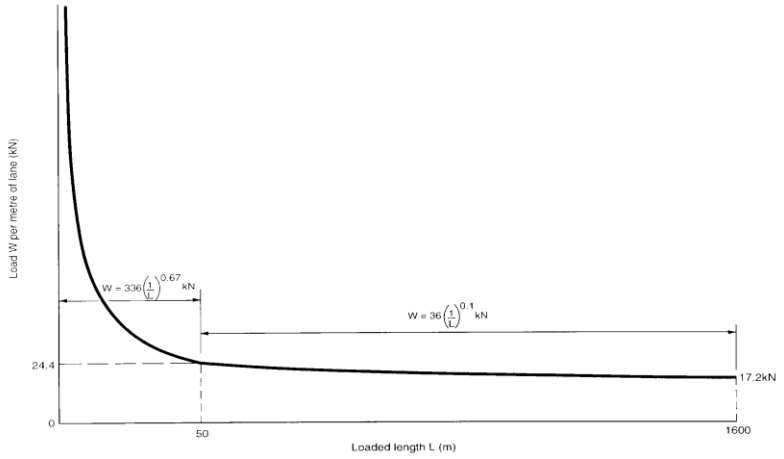


Figure 2.2-13 Loading curve for UDL of HA loading

HB Loading

Figure 2.2-14 shows the plan and axle arrangement for one unit of nominal HB loading. One unit is taken as equal to 10 kN per axle. The HB loading includes a dynamic effect.

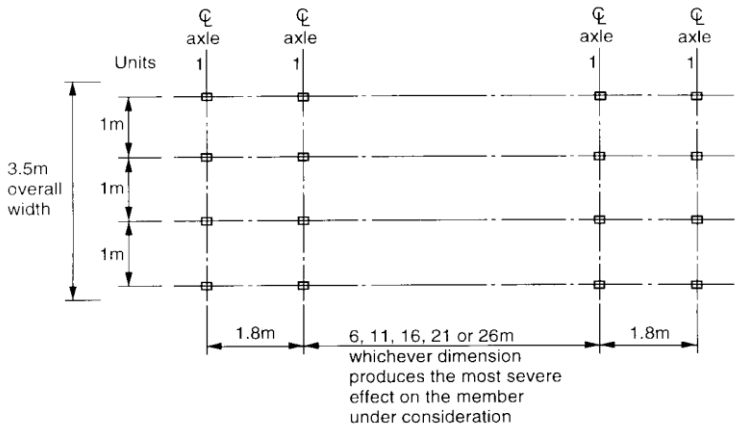


Figure 2.2-14 HB Loading of One Unit Vehicle

The overall length of the HB load is taken as 6, 11, 16, 21, 26 m and the load application length are determined for the such that the member is subject to the most severe condition. The load of one vehicle is 40 kN. For example, HB45 has a vehicle load of 45 units of 45 × 40 kN = 1800 kN.

To examine the live load effect, for 3-span continuous steel I-shaped girder bridge, as shown in Figure 2.2-15 with the length of 142 m (45 + 54 + 43 m), the values of bending moments at an intermediate support are calculated and compared. The result is summarized in Table 2.2-22.

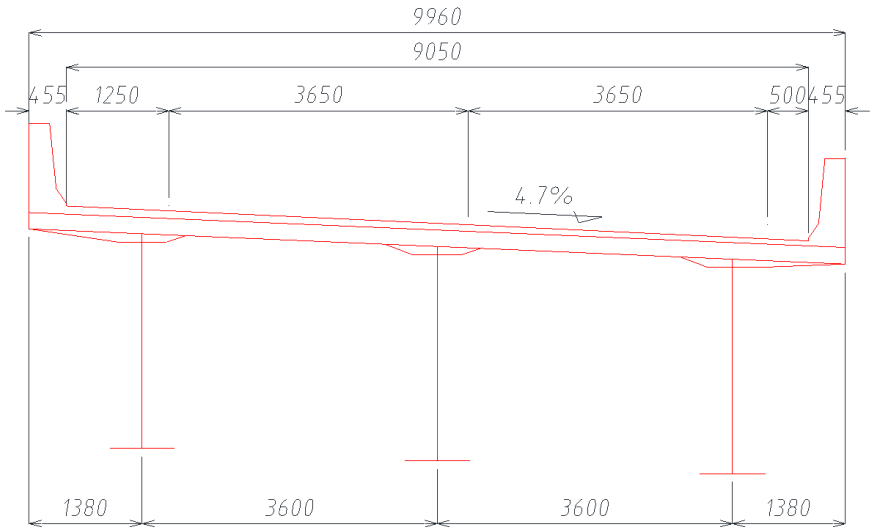


Figure 2.2-15 Typical Cross Section of Superstructure

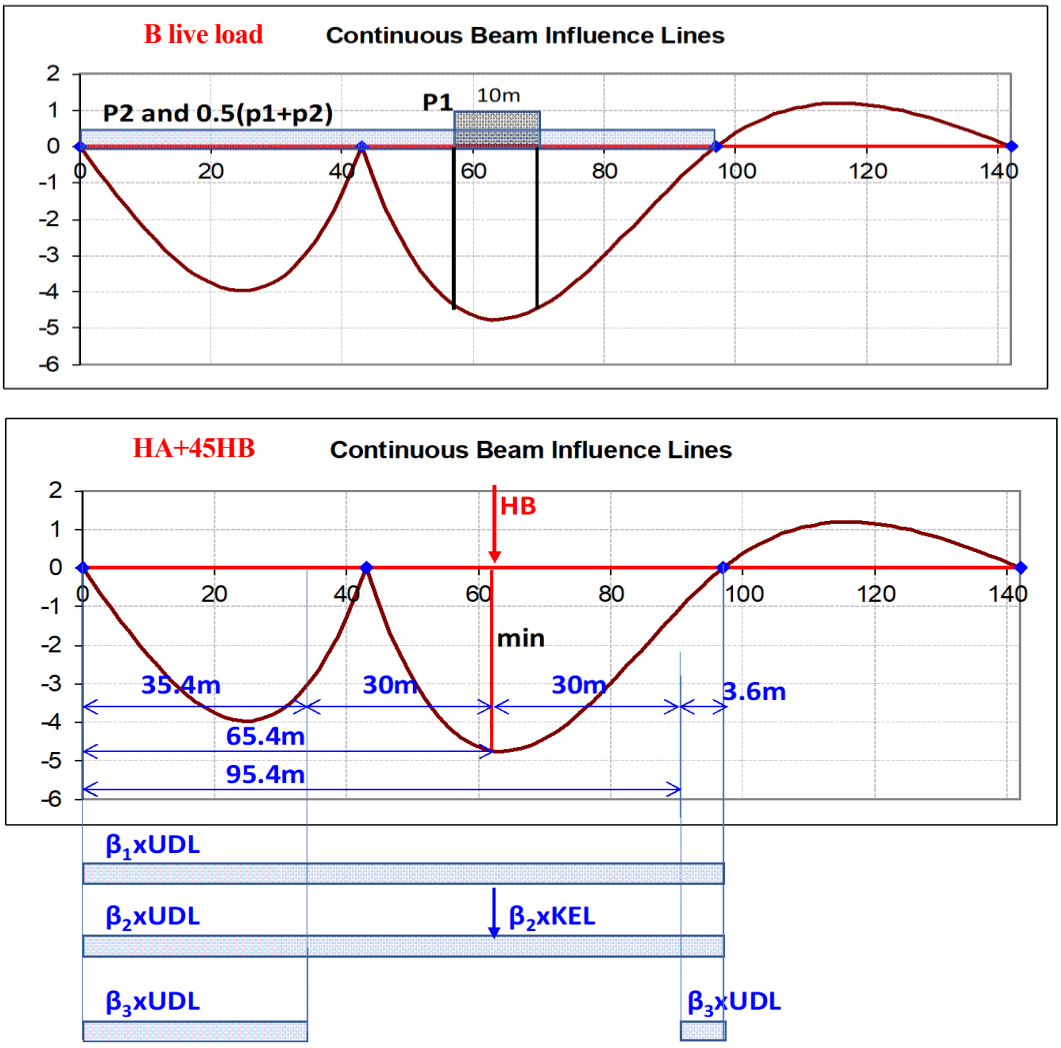


Figure 2.2-16 Live Load Application on Influence Line (Intermediate Support)

Table 2.2-22 Values of bending moment at an intermediate support (kNm)

B live load (Japan)	HA+45HB (BS5400)	(HA+45HB)/B live load
10,849	11,669	1.075

From the table above, the bending moment derived by applying HA + 45HB is about 7.5% larger than that by applying the B live load. From this result, for the safety level in yielding, the values of the B live load and the impact coefficient incorporate the 7.5% increment of load effect, and then the design is performed in accordance with the Specifications for Highway Bridges (JRA).

[Impact]

Application of live load will take into account the impact or the dynamic effect. Impact coefficient is calculated in accordance with the Specifications for Highway Bridges (JRA). The impact due to the live load is not considered in calculating the reaction forces which are used in the design of substructures.

[Wind Load]

Wind loads acting on piers and girders vary greatly depending on the location of the bridge, topography and surface conditions, bridge structural characteristics, and cross-sectional shape. In Ghana's bridge design data (2014), the average hourly wind speed within 160 km inland from the coast is V=21 m/s (100-year return period). According to the Specifications for Highway Bridges (JRA), the basic wind speed, V=40 m/s, is described. For the bridge design, the design wind speed, V=40 m/s, is adopted.

[Temperature Impact]

The design temperature in the vicinity of the bridge location varies from 8 degree Celsius to 51 degree Celsius (± 21.5 degree Celsius according to Ghana's bridge design data (2014). On the steel structure: -10 degree Celsius to 50 degree Celsius (± 30 degree Celsius). The one with the larger amount of temperature change is applied to the calculation of the amount of the movement on the support and the expansion joint.

[Seismic Design]

The seismic impact is taken into account in accordance with the Specifications for Highway Bridges (JRA), but the seismic ground motion varies depending on the regional nature. According to Ghana's bridge design data (2014), it defines that the amount of seismic load is set as 8% of the dead load. In Ghana's Building Code, a = 0.35 is adopted as the acceleration coefficient, so the design horizontal seismic coefficient Kh = 0.35 is considered in the static seismic design.

[Vehicle Collision Force]

Since the flyover (substructure) may be at the risk of vehicle collision, the flyover should be designed to be sufficiently stable against the collision impact. To consider this impact, the design impact force is defined in

accordance with the Specifications for Highway Bridges (JRA).

(3) Comparative Study of Superstructure and Substructure

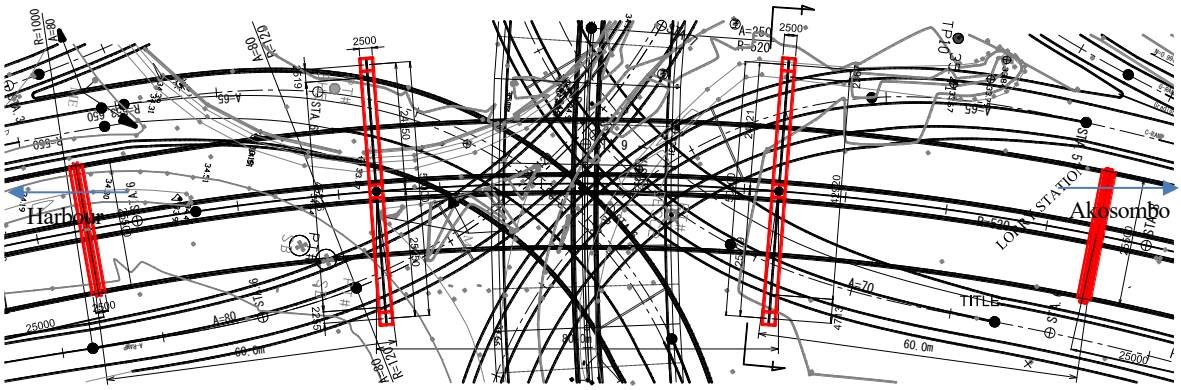
1) Bridge Length and Span Length

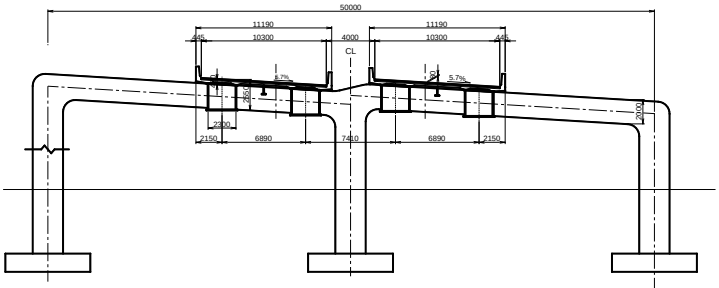
The flyover to be constructed in the Phase-2 has a bridge length of 400 m in total (125 m length of 5-span PC-I girder + 200 m length of 3-span steel box girder + 75 m of 3-span PC-I girder) considered in the Phase-1 survey. Based on the bridge length of the Phase-1, the intersection shape and ramp road alignment are planned and designed. Since the reduction of the bridge section greatly contributes to the reduction of the project cost, the bridge length was re-examined in the Phase-2 study.

In the Phase-1 survey, the pier of the main bridge over the intersection was planned to be a three-column steel frame pier. Due to the installation position of the middle steel column and the road vertical alignment, the flyover was planned to be a three-span continuous steel box girder bridge with rigid-connecting of superstructure and substructure. There is no restrictions on abutment position since the side span length 60 m of the main bridge planned in the Phase-1 was determined in consideration of the stress balance of the main girder.

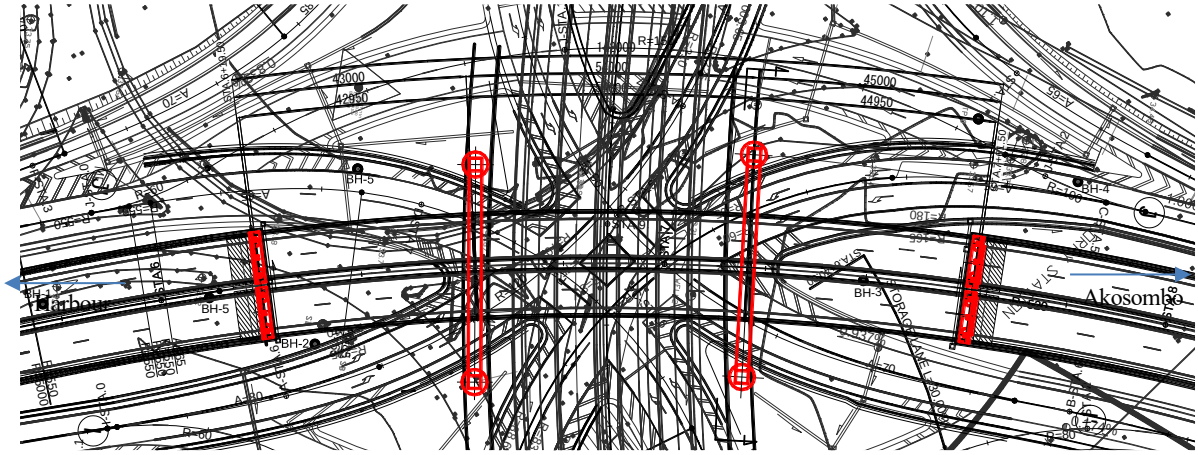
Therefore, the Phase-2 study examined the possibility of shortening the center span length. As a result, when the pier with more high-strength steel material is placed as close as possible to the box culvert of the Phase-1, the number of column of the steel frame pier can be changed to two from three for the original plan. With this change, the length of the center span and the bridge were reduced to 54 m and 142 m, respectively. In addition, the PC-I girder section planned in the Phase-1 is changed to the mechanically stabilized earth wall method. This is expected to lead to further reduction of the project cost. The bridge length and span arrangement are as shown in Figure 2.2-17.

Phase-1





Phase-2



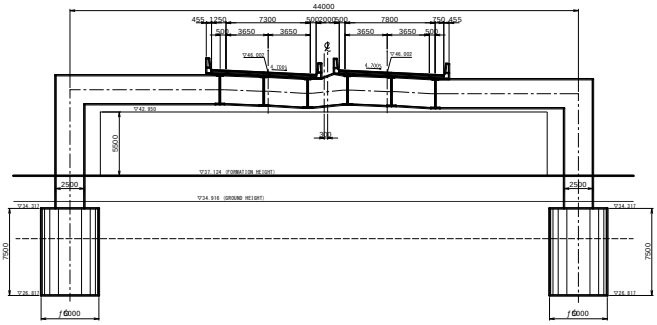
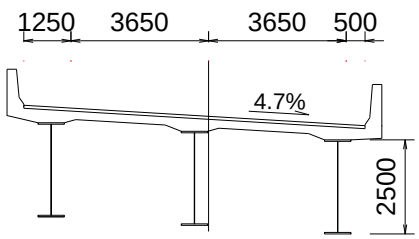
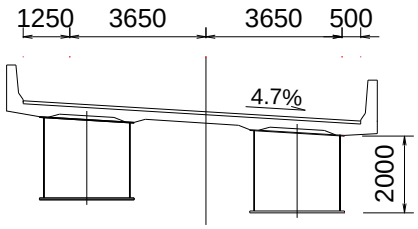


Figure 2.2-17 Bridge Length and Span Length

2) Comparison Study of Superstructure

Constraints in selecting the superstructure type are the vertical gradient, vertical and horizontal limits, and the range where piers can be installed. From the above-mentioned bridge length, the allowable height of the superstructure of this flyover (height from the road surface to the bottom of the girder) is about 3.0 m. It is physically not possible to apply a concrete bridge as simply estimating from the ratio of span to the girder height, for the given span the girder height will exceed the allowable height mentioned above. Therefore application of steel bridge was considered. For the given span, the applicable girders are the plate girder type and the box girder type. A comparative study between the 2 types, as shown in Table 2.2-23 were performed. The results conclude that Option-1, the plate girder is superior to the box girder.

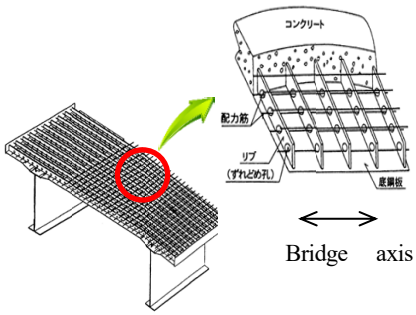
Table 2.2-23 Comparison Study of Superstructure

	Option-1 Plate Girder	**Option-2 Box Girder**
Cross Section		
Structure	It is inferior to Option-2 in terms of torsional rigidity, but is applicable as this type can be found in many bridges in Japan	Suitable for curved bridges as this has high torsional rigidity
Construction	The weight of the components is light compared to Option-2 and can be installed with a small crane.	Installation requires heavy crane as the girder is heavier than plate girders
Cost Efficiency	Estimated girder weight : approx 750 ton Superior to the second plan in terms of transportation also	Estimated girder weight : approx 1,000 ton The box girder is hollow and the unit price per weight is high in terms of transportation
Maintenance	Visual inspection from outside possible. Don't need special equipment or apparatus	The inside of the box girder gets hot and humid area and needs to be inspected regularly. Special equipment such as a blower is required for inspection inside the box girder.
Evaluation	**Superior (Recommended)**	Inferior

3) Comparison Study of Deck Slab

Table 2.2-24 shows the comparison of deck slab types. Although the initial cost is expensive, a steel-concrete composite slab is adopted as it is superior in terms of construction safety, maintenance efficiency and durability (contributes to long-term economic efficiency).

Table 2.2-24 Comparison Study of Deck Slab

	Option-1 Reinforced Concrete Slab	Option-2 Steel Concrete Composite Slab
Image	 General reinforced concrete deck slab	 ※ An example of a composite deck slab (Steel Bridge Technology Research Group web page) Base plate that also serves as a formwork and serves as a slab stress member using a composite structure of steel and concrete.
Thickness	280 mm	200 mm
Structure	Deck slab weight is 6.86 kN / m2 The impact on the main girder is larger than Option-2	Deck slab weight is 5.50 kN / m2 The impact on the main girder is smaller than Option-1
Cost Efficiency	Initial cost is low (deck slab unit price: approx 30,000 Japanese Yen/m3) at it can be procured locally. Superstructure cost is about 45 million Japanese Yen greater than Option-2	Initial cost is high (deck slab unit price: approx 50,000 yen / m3 + transportation cost) since it need to be procured from Japan. Superstructure cost is about 45 million Japanese Yen less than Option-1
Construction Efficiency	Requires scaffolding and support Construction schedule of the deck is longer than Option-2	Scaffolding and support are not required Construction period of the deck is shorter than Option-1
Safety	Since detour road is right below, careful attention is required for the installation and operation of support structures and scaffolds.	No impact to detour below.
Maintenance*	Compared to the second plan, it is less durable and requires multiple slab replacements during the service period	High durability, no need to replace floor slabs during service period
Evaluation	Inferior	**Superior (Recommended)**

＊Return period for design of major bridges in Ghana Bridge Design Data 2014 is 100 years

4) Pier Type

For the reasons mentioned below, a rigid frame that supports the superstructure is applied for the substructure (pier).

a) Minimum vertical clearance of 5.5 m is needed to be secured

b) The pier is required to be located outside the ramp at the at-grade intersection

From the above requirements, the flyover is not applicable to a steel girder mounted on a general concrete pier. Therefore, the type to be applied will be a gate type (gantry type) structure as shown Figure 2.2-18 in supported by the out riggers that are extended in the direction perpendicular to the bridge axis to the edge of the road.

If the outrigger is supported by a simple beam structure with hinges at both ends, the amount of vertical deflection at the center of the beam is large, and it is difficult to ensure sufficient rigidity at an allowable girder height. Therefore, a steel pier with a rigid frame structure that is rigidly connected at both ends and integrated with the main girder is adopted. The cross-sectional area of the steel pier will be minimized in accordance with the planned location and scale of the deep foundation pile to minimize the impact to the box culvert and the ramps of the intersection constructed in Phase-1.

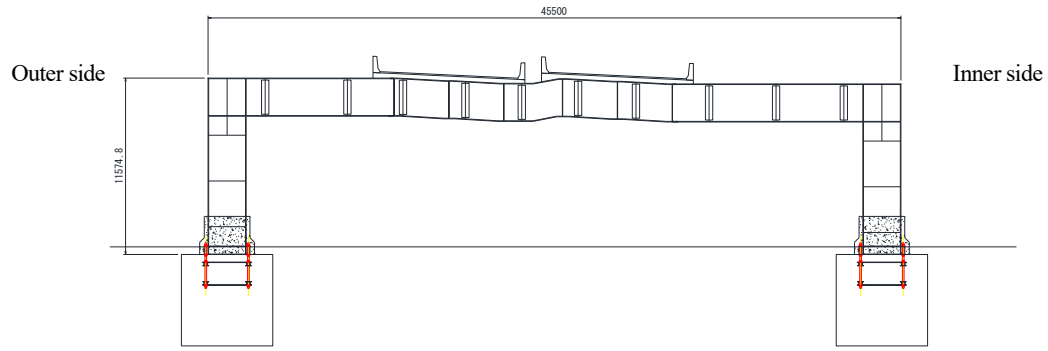
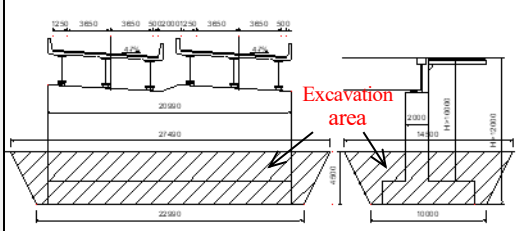
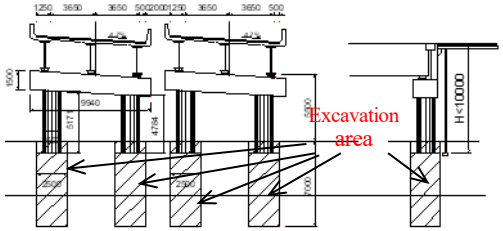


Figure 2.2-18 Integrated Steel Pier and Girder

5) Comparison Study of Abutment

The abutments of the flyover are about 10 m tall, which is generally higher than the normal abutments. In such case, commonly used inverted T type abutment is expected to have a wall thickness of about 2 m to withstand the large earth pressure that is exerted at the back side of the abutment. Therefore, a comparison was made with a reinforced earth wall-combined abutment that can support the earth pressure on the back and reduce the amount of concrete in the abutment. The examination results are shown in Table 2.2-25. Considering economic efficiency and workability, the reinforced earth wall combined abutment was adopted.

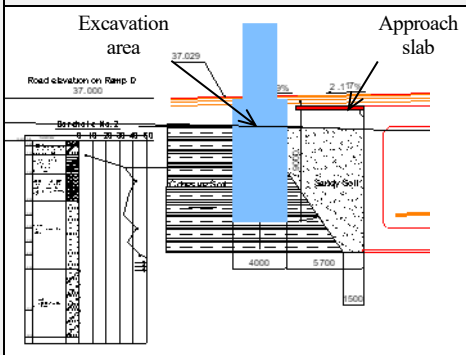
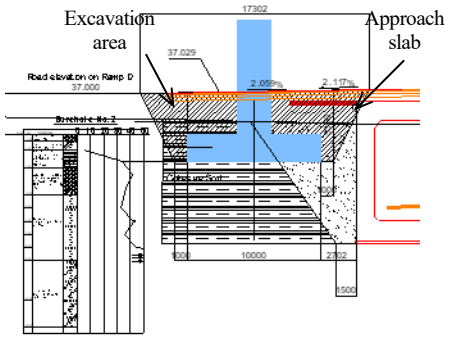
Table 2.2-25 Comparison of Abutment Type

	Option-1 (Reversed T Abutment)	Option-2 (Earth Retention Wall Combined Abutment)
Schematic Drawing		
Outline	Standard type. Footing is provided by excavating upto load bearing layer. The wall thickness increases with respect to the height of abutment to resist earth pressure exerted on the back of the abutment.	The earth pressure is retained by the reinforced earth wall and a pier-type abutment is provided in front of wall. Since the wall retains the earth pressure on the back side contributing to reduction of concrete volume of the abutment even though the height of the abutment is high.
Construction Efficiency	Earth volume to be excavated is big (approx. 2,800 m3) and so is the frequency of soil transport	Application of deep foundation pile minimizes excavation of soil volume (about 150 m^3) thereby reducing the frequency of soil transport
Cost Efficiency	Concrete volume：approx. 700 m^3	Concrete volume：approx. 300 m^3
Impact to Environment	Footing construction requires large amount of soil volume to be excavated. Ramps constructed in Phase-1 might be affected.	Minimizes excavation area and the ramps constructed in Phase-1 is unlike to be affected.
Overall Assessment	Inferior	**Superior (Recommended)**

6) Comparison Study of Foundation Type

According to the results of the drilling survey at the bridge position, the load bearing layer was found at G.L.-2 m to -5 m, which is the range where spread foundation application is possible. However, it is assumed that the scale of the direct foundation will be about 10 m x10 m (assumed from the construction of the railway bridge adjacent to the first phase construction), which is very likely to affect the approach slabs of the box culvert constructed in Phase-1. Therefore, minimization of impact on infrastructures constructed during Phase-1 is given due consideration along with construction and cost efficiency, and adverse impact to environment. The comparison is provided in Table 2.2-26. Cast-in-situ pile method, which is commonly used for foundations has been excluded from the comparison in view with the results of the geo-technical investigation (drilling) which indicates the load bearing layer in a rather shallow depth. The result of the comparison recommends use of Option-1, deep foundation pile.

Table 2.2-26 Comparison of Foundation Type

	Option-1 Deep Foundation Pile	Option-2 Spread Footing
Schematic Illustration		
Impact to existing structures	Although construction is close to existing structures (attention range 2), impact is minimal as excavation is possible without producing vibrations	The maximum depth is about 5 m, and the opening at the surface is about 17 x 17 m. Very likely to affect the box culvert constructed in Phase-1. Also, needs removal of approach slabs
Construction Efficiency	Large diameter requires heavy machinery, but small ones can be excavated manually Excavated soil volume is small and transport cost to the dumping site is also low	Requires excavation by heavy machines and utmost consideration is required to avoid from possible impacts to existing structures Excavated soil volume is huge and transport cost to the dumping site is high
Impact to Environment	Soil volume to be excavated is approx. 110 m3/pile	Soil volume to be excavated is approx. 1000 m3/foundation
Assessment	**Superior (Recommended)**	Inferior

2.2.2.4 Approach Road Plan

(1) Design Criteria

The section that connects the existing road and the flyover is defined as an approach road. The design of approach roads is carried out in accordance with the Road Design Guidelines of Ghana. Approach roads consists of two different classes of roads. The northern approach road is a part of Akosombo Road, which is classified as a national road. The southern approach road is a part of Harbor road and is an urban road. However, after improvement of the intersection, based on the discussion with GHA, the jurisdiction for approach road in the south, which connects with the urban road (harbor Road) and is originally belonged to the jurisdiction of DUR will be transferred to GHA.

Approach roads to be planned and designed under Phase-2 will include through traffics in the north-south direction. The lanes that cater for turning purpose have been designed and are under construction being carried out under Phase-1. Table 2.2-27 shows general and geometric conditions used for the design of both roads.

Table 2.2-27 Design Criteria (General and Geometric Condition)

HIGHWAY / ROAD CLASSIFICATION				National (Akosombo Approach)	Urban (Harbour Approach)
GENERAL					
Min. Design Speed (km/hr)	Flat Terrain (inside bracket for urban area)			100 (80)	80 (60)
	Rolling Terrain (inside bracket for urban area)			80 (60)	60 (40)
	Mountenous (inside bracket for urban area)			60 (40)	50 (30)
Level of Service				C	D
CROSS-SECTION ELEMENTS					
Road Cross Section Width	ROW Width (m)		Urban	90	-
	Min. Median (m)		Rural	10	4
			Urban	2- 4	2- 4
	Median Shoulder			0.3 - 0.5	0.3 - 0.5
	Vehicle Lane		Flat/Rolling	3.65-3.25	3.65-3.25
			Mountenous	3.5-3.25	
	Ramp width (m)			-	
	Right Shoulder (m)		Flat/Rolling	2.50	2.0 - 3.0
			Mountenous	3.00	-
VERTICAL ELEVATION CONTROLS					
Minimum Vertical Clearance (m)		Carriageway		5.5	5.5
		Sidewalk		2.5	2.5
TRAFFIC VOLUME					
Design Traffic Volume (ADT)				>10,000	<150
STRUCTURE LOADING					
Structure Live Loading (Minimum)					
PAVEMENT STRUCTURE					
Pavement	Surface Type				
	Crossfall (%)			1.5 - 2.5	1.5 - 2.5
GEOMETRIC CONDITIONS					
HORIZONTAL ALIGNMENT				**100**	**40**
Min. Horizontal Curvature		Desirable (5% SE)	m	700	100
		Minimum (9%SE)	m	370	50
Maximum Superelevation			%		
Min. Curvature Length			m	170	70
Min. Transition Curve Length			m	56	22
Radius not requiring Transition Curve			m	910	150
Values of Superelevation with respect to Radius of Curvature			6%	694	174
			5%	849	212
			4%	1091	273
			3%	1348	347
			Reverse (2%)	2560	525
Min. Radius not requiring Superelevation			m	5000	800
Superelevation Run-off				1/175	1/100
VERTICAL ALIGNMENT					
Max. Gradient		Standard	%	3	7
		Gradient with limitations	% (m)	4% (700m)	8% (400m)
			% (m)	5% (500m)	9% (300m)
			% (m)	6% (400m)	10% (200m)
Sight Distance		Stopping	m	160	40
		Passing	m	620	210
Min. Radius Crest Curve		K-Value		64	4
		Radius	m	6400	400
Min. Radius Sag Curve		K-Value		28	5
		Radius	m	3000	500
Min. Vertical Curve Length			m	85	35

Note: Those not provided in GRDG is referred from AASHTO's Standard as shown by the italic figures

(2) Applicable Standards

The improvement plan of the intersection fundamentally follows the prevailing standards and guidelines of

Ghana. Other international standards and guidelines as listed below are referred to items not covered in the Ghanaian standards. The above policy regarding standards and guidelines has been agreed with GHA.

1) Road/Intersection Planning and Design
   - Road Design Guide (GHA, March 1991)
   - A Policy on Design of Highways and Streets (American Association of State Highway and Transportation Officials: AASHTO, 2001)
   - Highway Capacity Manual (Transportation Research Board, 2010)
   - Japan Road Structure Ordinance June, 2015
2) Planning and Design of Structures (Retaining Walls, Culverts etc.)
   - Design Guideline for Retaining Wall (Japan Road Association, 2010)
   - Design Guideline for Culvert (Japan Road Association, 2010)
3) Pavement Design
   - Guide for Design of Pavement Structure (American Association of State Highway and Transportation Officials: AASHTO, 1993)
4) Drainage Design
   - Road Design Guide (GHA, March 1991)
   - Guidelines for Drainage Design (Japan Road Association, 2006)
5) Street Lighting Design
   - Road Lightning Installation Guidelines and Explanation (Japan Road Association, 2007)

(3) Horizontal Alignment

Horizontal alignment of Phase-2 (alignment of flyover and approach as highlighted in blue in Figure 2.2-19) was planned and agreed upon with GHA during preparatory survey of Phase-1. The alignment was reviewed and the results confirmed that the proposed alignment needs no alternation as it meets the design criteria as required by the GHA guidelines shown in Table 2.2-27, the control points identified during delineation of the alignment remains unchanged, new potential control points were not affirmed and the on/off ramps of the target road is already being constructed under Phase-1.

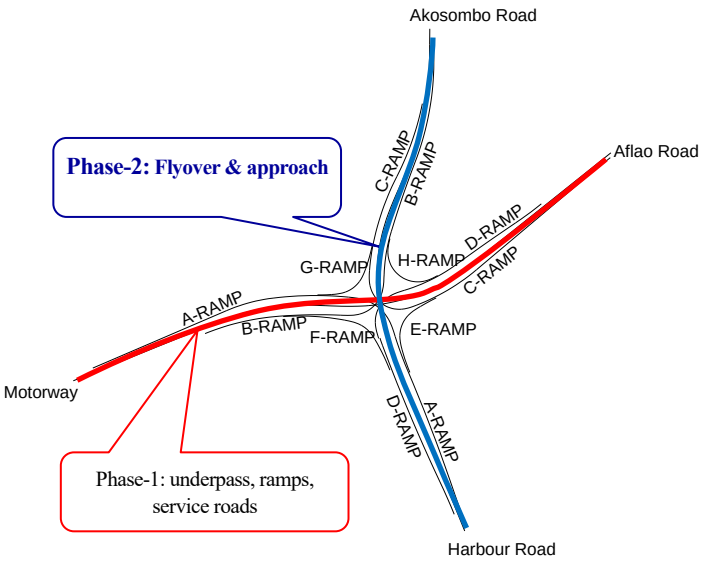


Figure 2.2-19 Horizontal Alignment

(4) Vertical Alignment

Vertical alignment was also planned and agreed during the preparatory survey of Phase-1. The alignment satisfies vertical clearance (5.5 m from road surface to the bottom of flyover girder) and other geometric requirements given in Table 2.2-27. The maximum grade was limited to 4.0% taking smooth and safe flow of high volume of large and heavy vehicles that use the Tema Port.

(5) Cross section

The cross section elements of the approach section include the median, strips (inner shoulders), carriageways, outer shoulders, and railings. The width of each element is as shown in Table 2.2-28. The standard cross slope is 2.5% and the steepest superelevation is 4.7%. The typical cross section of the approach section is shown in Figure 2.2-20.

Table 2.2-28 Cross section Elements and Widths

Railings	Shoulder (outer)	Carriageway	Shoulder (inner)	Median
0.5 m	1.25 m	7.3 m (3.65 x 2)	0.5 m	2.0 m

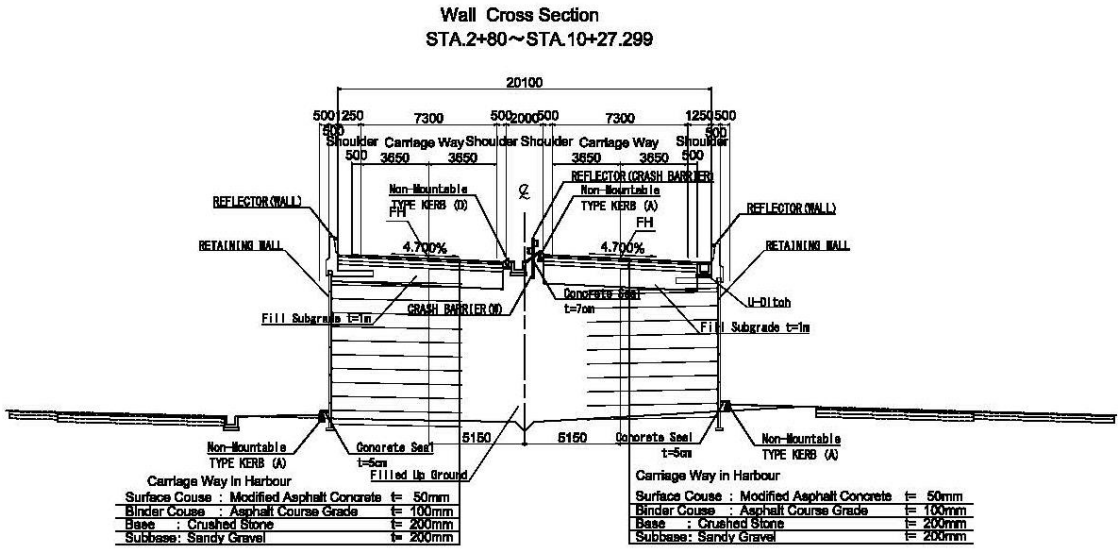
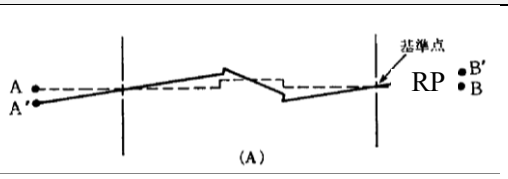
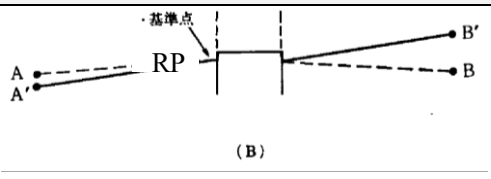


Figure 2.2-20 Typical Cross Section (Diagram not included in the hardcopy document)

(6) Reference Point (Axis)

There are two methods in determining the reference points (axis) of a road for the design of vertical alignment and cross section on divided highways. These methods are described in Table 2.2-29. As the objective roads are wide (4-10 m median strip with dual or triple lane double carriageway) and has a superelevated section of about 800 m, the effect on the abutting houses/residences or facilities as well as to the sectional area of the box culvert at the underpass is less if the reference point is taken in the middle of the carriageways. Therefore, Type A is applied for the alignments in this project.

Table 2.2-29 Reference Point (Axis)

Items	Type A : Middle of Carriageway	Type B : Edge of Median
Image		
Feature	Applicable to superelevated sections. Elevation difference between right and left edge of the road can be smaller	Since RP is close to center of the road, it is simple to design according to design standard.
Condition	Having median and being large in width	Particularly None
Applied	○	–

(7) Design Vehicle

WB-20 classified by AAHTO and agreed with GHA during Phase-1 will apply for Phase-2 design vehicle. The basic dimension of the vehicle is illustrated in Figure 2.2-21.

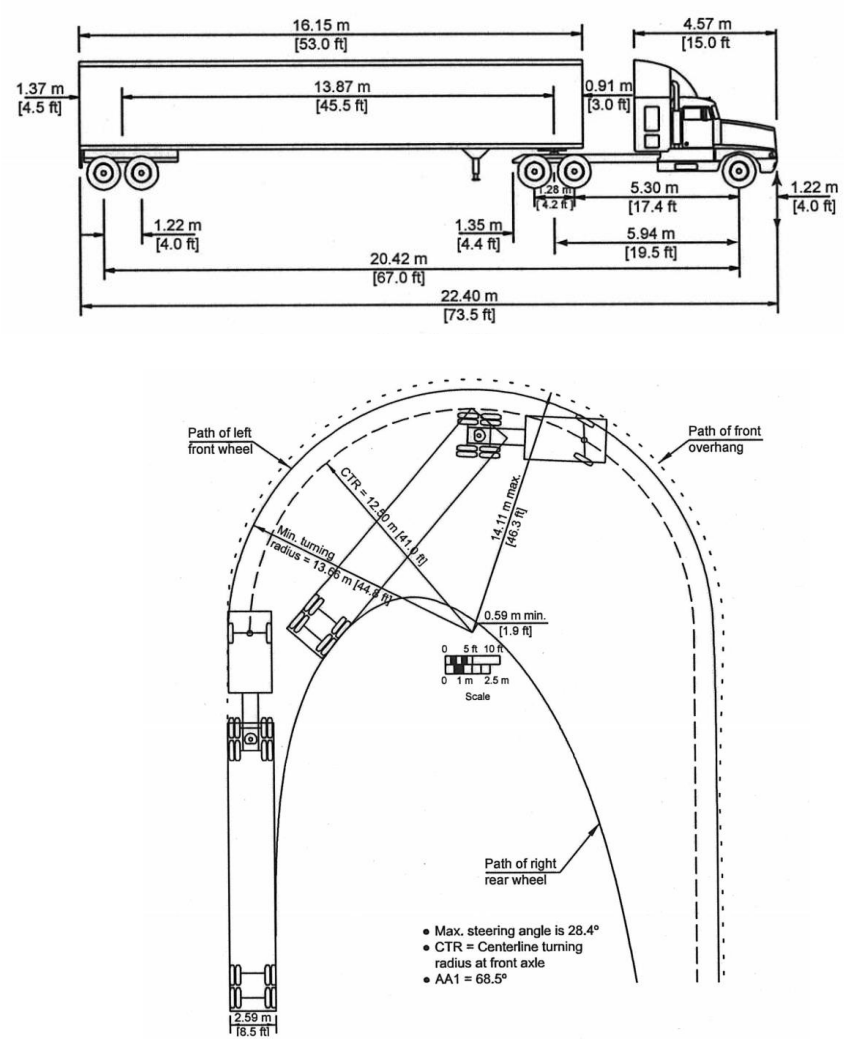
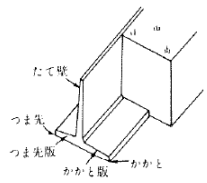
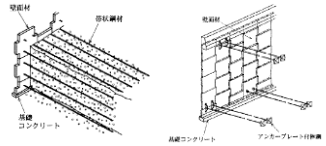
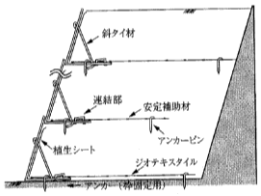


Figure 2.2-21 Design Vehicle

(8) Retaining Structures

The approach roads are elevated making it higher than the ramps/existing ground. The ramps were planned in Phase-1 under the precondition that the elevated section of the approach road will be retained by structures. During Phase-2, the optimum method for retaining structures was studied. Reinforced earth wall method was selected from among the methods shown in Table 2.2-30. This method has minimal adverse impact on the ramps (infrastructures) of which was already constructed and is superior to other methods in terms of cost-efficiency, construction ability and aesthetics. In addition, this method is getting popular in Ghana recently.

Table 2.2-30 Comparison of Retaining Structures

Method	Reinforced Concrete Wall	Mechanical Stabilization Earth (MSE) Wall	
		Concrete Face Type	Type Vegetation Face Type
Overview		 Steel Strip Type　Anchor Bar Type	
Structural	Reinforced Concrete Wall is the most general retaining wall method, which resists as a cantilever against the backside earth pressure.	This method is one of MSE method with concrete wall face, that produces the earth retaining effect by pulling resistance due to the frictional force between the steel strip plate (or anchor bar) and the embankment material arranged in layers in the embankment.	This method is one of MSE method with vegetation wall face, that produces the earth retaining effect by pulling resistance due to the frictional force between the geogrid and the embankment material arranged in layers in the embankment.
Applicable Height	H≦8 m	3≦H≦18 m	3≦H≦18 m
	Evaluation: Not Applicable	Evaluation: Applicable	Evaluation: Applicable
Applicability	Concrete Wall cannot be constructed at the site because it exceeds the applicable height.	This MSE method has been experienced in Ghana, and there are no particular problems with its adoption.	This MSE method can be applicable in terms of the height. But because the site is in urban area, it is not preferable in terms of maintenance work such as mowing.
	Evaluation: Not Applicable	Evaluation: Applicable	Evaluation: Fair
Total Evaluation	Not Applicable	Superior (Recommended)	Inferior

(9) Pavement Plan

Future traffic volume in Phase-1 was calculated based on the results of traffic survey and analyzed during the preparatory survey. The results were applied in determining the pavement structure (composition) of the then target roads. As shown in the analysis results described in Section 2.2.2.1(1), there is no significant difference between the traffic volume forecasted for 2019 in Phase-1 and the traffic volume actually measured under this survey. On the other hand, the CBR of the subgrade has not been subjected to significant change. Therefore, both approach roads will have the same pavement structure as Phase-1. Table 2.2-31 shows the pavement composition of each approach road. A description of the pavement plan in the Phase 1 report, “3-2-3-4 Pavement Plan,” is attached in Appendix-7.

Table 2.2-31 Pavement Composition of Approach Roads

Approach Road	Harbour Road (Start point - Flyover)	AkosomboRoad (Flyover - end point)
Wearing/Surface Course	5 cm	5 cm
Binder Course	10 cm	8 cm
Base Course	20 cm	15 cm
Sub-base Course	20 cm	20 cm

Goose asphalt, generally used in the steel slab will be used for pavement on top of the flyover (bridge). The pavement thickness commonly applied is 6-8 cm, but considering the traffic characteristics of the road of the project area, where there are many large trucks, it is set to 8 cm. Modified asphalt with improved fluidity and enhanced wearing durability by mixing polymer or runner with straight asphalt as in Phase-1 is planned to be provided for on the wearing/surface course of the access road including the bridge.

(10) Traffic Safety Facility and Ancillary Plan

In Phase-1, road lighting is planned to be installed in the east-west direction and north-south ramps. In this phase, road lighting will be installed in the straight lane section in the north-south direction. The median strips will be installed in the approach road section, and the handrails will be installed in outside of the bridge section. In addition, safety facilities such as road signs, fall prevention fences, road markings etc. are planned. The design standard was in accordance with the Japanese stadard "Road Lighting Facility Installation Standards and Explanations, Japan Road Association, October 2007".

2.2.2.5 Study on Ashaiman Roundabout Improvement

(1) Outline

The location and general features of Ashaiman Roundabout is presented in Figure 2.2-22. Ashaiman Intersection is a 4-leg roundabout with an inscribed circle diameter of about 50 m and is located about 1.5 km north of Tema Intersection. 3 out of 4 legs are single lane --only Ashaiman Road, the west leg is a dual carriageway-- and the circulatory road has 2 lanes. The roundabout has been experiencing traffic congestion throughout the day time even before the commencement of Phase-1 preparatory survey. The congestion is severe during peak hours.

The improvement of Ashaiman Roundabout is not included in the scope of this survey. However, improvement of the roundabout is indispensable to eliminate the congestion that occasionally affects the flow at Tema Intersection. A brief study on causes of the congestion is conducted and suggestion for remedial measures is forwarded.

Figure 2.2-22 Akosombo Road – Ashaiman Roundabout

(2) Current Situation

As aforementioned, Ashaiman Roundabout is almost always severely congested. Some reasons for the congestion among others are;

- The roundabout is non-symmetric (not standard type)
- Lacks distinct/channelized slip roads
- Number of lanes uneven (Ashaiman 2- lane, others 1- lane)
- Shorter weave lengths (close entry & exits)
- Partially functioning drainage
- Imbalanced traffic volume on the legs
- Crowded by vendors, kiosks, street vendors jay walkers
- Siltation of roads causing pollution thereby causing speed retardation
- No footpaths, lane markings causing disorderly crossings at the roundabout

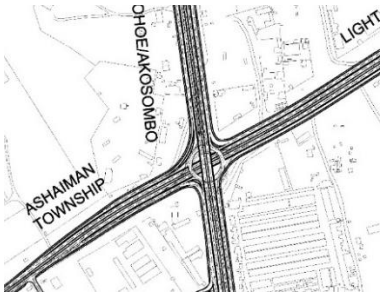


Figure 2.2-23 Improvement Proposed by Third Country Study

In 2013, a third country consultant conducted a feasibility study on the improvement. The improvement proposed by the study is indicated in Figure 2.2-23. It proposes grade separated lanes for through traffics and an at-grade roundabout to cater for turning vehicles.

(3) Policy for Improvement under this Survey

Comprehensive improvement is ideal. However, the survey considers improvement in phases, temporal improvement and then permanent improvement. First improvement will apply slip roads to provide exclusive lanes for right-turning vehicles on all legs.The fact that slip roads contribute to a certain limit in alleviating traffic congestion has been substantiated by the MPS project at the then Tema Roundabout. The next step is to convert to signalized interchange or to grade separated intersection, similar to Tema Intersection.

(4) Study Contents

1) Methodology and Output

As shown in Table 2.2-32, a three-stage development plan that will improve traffic capacity was considered as the study case. Analysis based on HCM2010 (static) and continuous traffic micro simulation (dynamic) for the configuration of each case was done. The year when the capacity of the improvement method reaches the limit was taken as the output of the analysis.

Table 2.2-32 Study Cases

Case No.	Study Cases (Improvement Method)
Case-0	Existing (No improvement)
Case-1	At-grade improvement (4-lane upgrading of south-leg (Ashaiman Roundabout– Tema Intersection stretch), provision of slip roads on all legs, and expansion of circulatory lanes of the roundabout
Case-2	Signalized at-grade intersection (provision of left-turn exclusive lanes)
Case-3	Grade separation of north-south direction (Prioritizing the East Corridor)

2) Outline of Study

[Case-1 : At-grade Improvement]

Improvements to be applied are as follows, which is illustrated in Figure 2.2-24.

i) Widening of Akosombo Road on the south side to 4-lane (4-lane is recommended to maintain consistency with the improvement of Tema Intersection)

ii) Provision of slip roads (single lane) at all legs and connect lanes to roundabout to allow free flow to vehicles turning to the right.

iii) Dualization of roundabout circulatory roads (currently the circulatory road of the roundabout seems to have 10 m width but is not sufficient to cater smooth and safe flow to heavy vehicles)

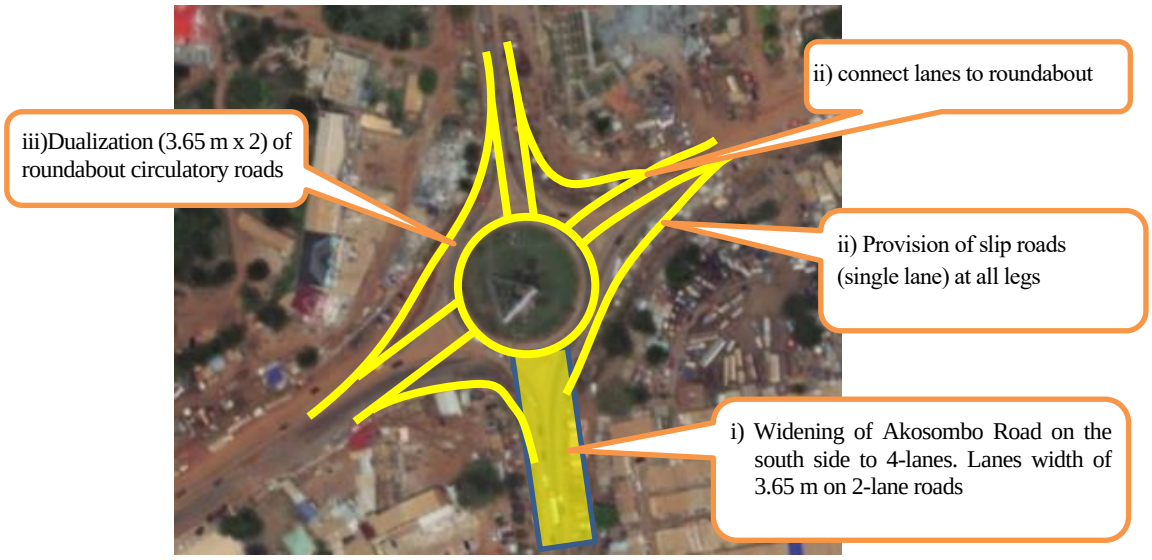


Figure 2.2-24 Case-1 : At-grade Improvement

[Case-2 : Signalized at-grade Intersection]

Improvements to be applied are as follows, which is illustrated in Figure 2.2-25.

i) Signalized Intersection (provision of exclusive left lanes)

* The roundabout will be converted to an at-grade intersection controlled by traffic signals. All traffics going straight and turning left will meet at the intersection. Slip roads provided in Case-1 is used continuously.

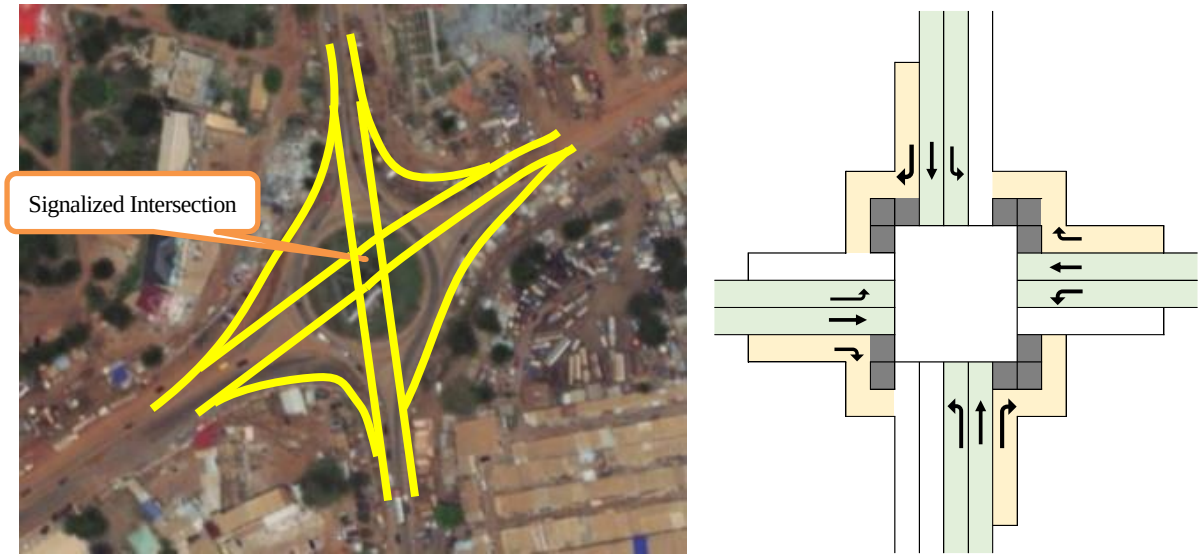


Figure 2.2-25 Case-2 : At-grade Signalized Intersection

[Case-3 : Grade Separation of North South Direction]

Improvements to be applied are as follows, which is illustrated in Figure 2.2-26.

i) Grade separation of north-south direction (dualization of carriageway on both direction)

ii) Left-Turing vehicles on north-south direction to be connected with the roundabout by off-ramps

iii)Connecting east-west direction to the roundabout provided in Case-1

* Slip roads provided in Case-1 is used continuously.

* Roundabout having dual-lane circulatory road improved in Case-1 is used continuously.

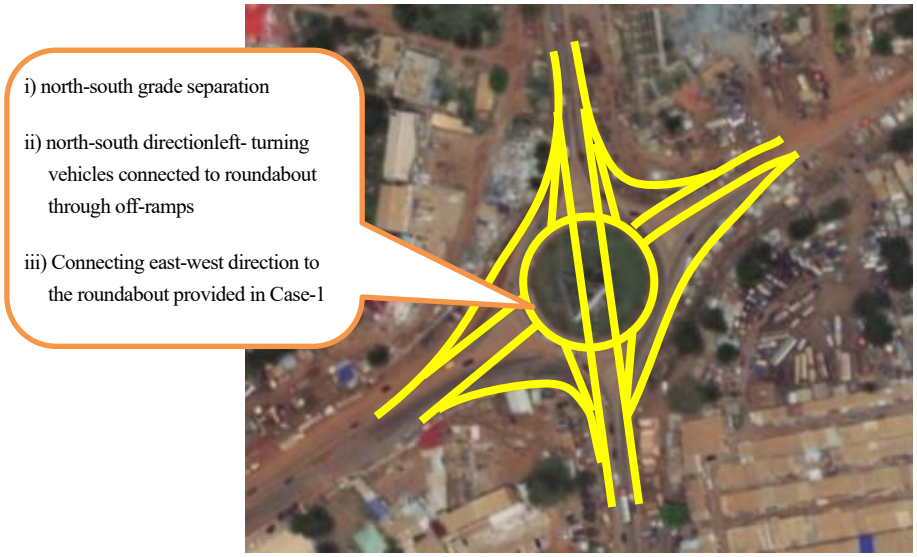


Figure 2.2-26 Case-3：North-South Direction Grade Separation

3) Study Results

Study results are compiled in Table 2.2-33. Case-0, the existing condition (do nothing scenario) shows that the capacity of the roundabout already exceeded causing severe traffic congestion throughout the day.

Case-1 improvements will ease the current congestion. However, the roundabout will exceed its capacity in 2022 and will be in similar condition like in the present.

Similarly, Case-2 improvements will improve the situation until 2025. In this case, all direction except for the east leg will exceed the capacity and see significant traffic congestion.

Finally, Case-3 improvements will be a solution for further easing of the traffic congestion. And this will show positive results until 2028.

Note that the simulation has been conducted in a worst scenario meaning although it reflects the current improvements being applied at Tema Intersection, including improvement to be applied in Phase-2, it does not reflect other potential developments/improvements in and around Ashaiman Roundabout. The results may differ, possible in a positive manner, should improvement works pertaining to road network is carried out in near future.

A 3-tier intersection would be the optimum solution and could be applied anytime but the scope of the improvement will be big.

Table 2.2-33 Study Results

Case No.	Limit Year	Result of Traffic Simulation for the Limit Year
Case-0 (Existing)	Traffic volumes exceeds capacity	
Case-1	2022	
Case-2	2025	

Case No.	Limit Year	Result of Traffic Simulation for the Limit Year
Case-3	2028	

2.2.3 Outline Design Drawings

Outline Design Drawing is attached in Appendix-6 and its table of contents is Table 2.2-34.

Table 2.2-34 Table of Contents

No.	DRAWING TITLE	SHEET NO.	No. of Sheets	No.	DRAWING TITLE	SHEET NO.	No. of Sheets
1.	**GENERAL**	**GN - 01 ~ 09**	**9**		DIRECTION SIGNS(1)~(7)	RA - 29 ~ 35	7
	GENERAL NOTES(1)~(3)	GN - 01 ~ 03	3		DETAIL OF NOSE(1)~(2)	RA - 36 ~ 37	2
	PROJECT LOCATION MAP	GN - 04	1	**12.**	**TRAFFIC SIGNAL LIGHT(1)~(8)**	**SL - 01 ~ 08**	**8**
	KEY PLAN	GN - 05	1	**13.**	**ROAD LIGHT(1)~(18)**	**RL - 01 ~ 18**	**18**
	ALIGNMENT LAYOUT(1)~(4)	GN - 06 ~ 09	4	**14.**	**BRIDGE**		**29**
2.	**PLAN(1)~(6)**	**PL - 01 ~ 06**	**6**		GENERAL ARRANGEMENT OF BRIDGE	**GB - 01**	**1**
3.	**PROFILE(1)~(3)**	**PR - 01 ~ 03**	**3**		GENERAL ARRANGEMENT OF SUPERSTRUCTURE(1)~(2)	**SP - 01 ~ 02**	**2**
4.	**TYPICAL CROSS SECTION**	**TP - 01**	**1**		SECTIONAL FORCES AND PROPERTIES(1)~(12)	**SF - 01 ~ 12**	**12**
5.	**CROSS SECTION(1)~(36)**	**CR - 01 ~ 36**	**36**		GENERAL ARRANGEMENT OF SUBSTRUCTURE(1)~(2)	**SB - 01 ~ 02**	**2**
6.	**PAVEMENT STRUCTURE**	**PS - 01**	**1**		CROSS SECTION OF PIER 1	**P1 - 01**	**1**
7.	**INTERSECTION PLAN**	**IP - 01**	**1**		CROSS SECTION OF CAISSON PILE OF PIER 1	**P1 - 02**	**1**
8.	**DRAINAGE PLAN(1)~(6)**	**DP - 01 ~ 06**	**6**		CROSS SECTION OF PIER 2	**P2 - 01**	**1**
9.	**DETAIL OF DRAINAGE(1)~(5)**	**DR - 01 ~ 05**	**5**		CROSS SECTION OF CAISSON PILE OF PIER 2	**P2 - 02**	**1**
	SIDE DITCH	DR - 01	1		CROSS SECTION OF ANCHOR FRAME	**AF - 01**	**1**
	CATCH BASIN	DR - 02 ~ 03	2		REINFORCED REBAR ARRANGEMENT OF CAISSON PILE OF PIER	**PC - 01**	**1**
	CROSS DRAINAGE	DR - 04	1		GENERAL ARRANGEMENT OF ABUTMENT 1	**A1 - 01**	**1**
	SCHEDULE OF DRAINAGE	DR - 05	1		REINFORCED REBAR ARRANGEMENT OF ABUTMENT 1	**A1 - 02**	**1**
10.	**REINFORCED EARTH WALL(1)~(9)**	**RE - 01 ~ 09**	**9**		REINFORCED REBAR ARRANGEMENT OF COLUMN OF A1	**A1 - 03**	**1**
11.	**ROAD ANCILLARIES**	**RA - 01 ~ 37**	**37**		REINFORCED REBAR ARRANGEMENT OF CAISSON PILE OF A1	**A1 - 04**	**1**
	ANCILLARY PLAN(1)~(6)	RA - 01 ~ 06	6		GENERAL ARRANGEMENT OF ABUTMENT 2	**A2 - 01**	**1**
	LAYOUT OF REFLECTOR(1)~(6)	RA - 07 ~ 12	6		REINFORCED REBAR ARRANGEMENT OF ABUTMENT 2	**A2 - 02**	**1**
	MEDIAN BLOCK,KERB AND EDGE BLOCK	RA - 13	1	**15.**	**REFERENCE DRAWINGS**	**RD - 01 ~ 06**	**6**
	CRASH BARRIER	RA - 14 ~ 15	2		STRUCTURE REMOVAL PLAN(1)~(6)	RD - 01 ~ 06	6
	REFLECTOR	RA - 16	1				
	LAYOUT OF PAVEMENT MARKINGS(1)~(8)	RA - 17 ~ 24	8				
	PAVEMENT MARKINGS(1)~(2)	RA - 25 ~ 26	2				
	TYPICAL TRAFFIC SIGNS(1)~(2)	RA - 27 ~ 28	2		*Total number of sheets*		175

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

The basic policies for implementation of the project are as follows:

- The project will be implemented under the Grant Aid Scheme of the Government of Japan (GOJ) in accordance with the Grant Agreement (G/A) and the Exchange of Notes (E/N) between the Republic of Ghana and the GOJ.
- The executing agency for the implementation of the project is Ghana Highway Authority (GHA) of the Republic of Ghana.
- The consulting services including detailed design, tender-related works and construction supervision services will be provided by a Japanese consulting firm(s) in accordance with the consultancy contract that shall be signed with the Republic of Ghana.
- The construction will be executed by a Japanese construction firm(s) that shall be selected through pre-qualification and bidding, in accordance with the construction work contract that shall be signed between the said construction firm(s) and the Republic of Ghana.
- The basic policies for the construction/procurement of this project are as follows:
  - The construction will give high consideration to minimize adverse impact to the infrastructures constructed in Phase-1.
  - The equipment, materials and labor for construction will be, to the possible extent, procured locally. Where local procurement is impractical, third country procurement or procurement from Japan will be considered given the required quality and supply quantity are secured.
  - Construction methods and the construction processes shall be consistent with the local climate, topography, geology and natural conditions.
  - Construction methods that are common and easy and will not require special or sophisticated equipment or technology will be applied.
  - The contractor's site organization shall be planned to satisfy the established construction specifications and construction management standards set for this project. Likewise, the consultant's organization shall be based on such specified project management standards.
  - To ensure safety during construction, an appropriate traffic management plan including deployment of traffic personnel at vantage positions shall be considered.
  - In order to reduce the influence of construction works on the environment of project site, appropriate preservation methods of the environment, such as the selection of temporary garbage

dumping sites which were specified from the Republic of Ghana shall be adopted.

2.2.4.2 Implementation Conditions

(1) Labors

Following points were identified from the field survey carried out with regards to local labors in Ghana.

- There are less than 10 contractors with track records of flyover and road improvement.
- Civil engineers, bridge engineers, bridge skilled labors, skilled workers, scaffold workers, welder, form builder, and machine operators can be procured from the site and from Accra.

From above, workers for construction of superstructures who have high skill and experiences are planned to be procured from Japan.

(2) Labor Regulations

Ghana labor laws defined labor conditions are as follows;

1) General Working Hours

Daytime work is limited to 8 hours per day and 48 hours per week. Dayshift is between 6:00 am and 8:00 pm, and night shift is between 8:00 pm to 6:00 am

2) Overtime

Overtime and working on holidays require allowances equal to the basic salary

3) Protective Measures for Workers' Salary

According to the law, payment of workers takes precedence over other debts. Workers' salaries are not affected by bidding, bankruptcy or succession and must be paid immediately.

4) Bonus(13^{th} month Salary)

After one year (12 months) of continuous work, the workers have the right to receive a one-month (13th month) additional salary. In addition, if the work period is between a month and a year, the workers have the right to receive additional salary as stipulated in the employment contract for the corresponding period.

5) Dismissal

Employers are obliged to pay a worker a month's salary if they are dismissed after working continuously for one year. Table 2.2-35 shows major engineer/labor procurement categories.

Table 2.2-35 Major Engineer/Local Procurement Categories

Item		Category			Procurement from and conditions
Work	Specification	Ghana	Japan	Third	
General Caretaker (Manager)		✔			Accra
In charge of Bridge Works	Bridge construction		✔		Japan
Bridge Skilled Worker	Bridge construction		✔		Japan
Painter (Bridge)	Bridge construction		✔		Japan
Crane Operator	Bridge construction		✔		Japan Truck crane 60t, 160t
Workers (general, skilled)		✔			Accra
Drivers (Crane)		✔			Accra
Scaffold Worker, Welder		✔			Accra
Iron. stone worker		✔			Accra
Traffic Controller		✔			Nearby site area
Form builder		✔			Accra
Electrician			✔		Japan

(3) Policy on Labor Procurement

Being a grant aid of Japan, the contract is awarded to a Japanese firm. However, labors such as construction supervisor, skilled workers, and skilled drivers, if required, for the construction of this project can be procured from the local contractors. Execution of works other than steel bridge installation can be carried out through sub-contracting to these firms

(4) Procurement Policy on Major Construction Material

Major construction materials other than those pertaining to the steel bridge can be procured locally.

(5) Procurement Policy on Construction Machines/Equipment

Local contractors in Accra can procure and provide most of the construction machines required for the construction. Also, common machines with high versatility such as backhoes and bulldozers are easy to procure as these are available for lease. Cranes up to 300 ton is also procurable locally.

(6) Points to be Considered during Construction and Procurement

1) Securing smooth Traffic Flow during Construction

Serving as a nodal point between national roads, Tema Intersection is a strategically very important intersection. The intersection receives more than 32,000 vehicles per day. A biggest issue during construction is to secure safe and smooth detours for the existing traffics. Therefore, construction methods that does not hinder existing traffic operations is inevitable. To secure sufficient construction space of the intersection, an elliptical-shaped roundabout with semi-major axis in the north-south direction will be provided. Vehicles using the route that need to turn are only those going to the left direction. Therefore, this is deemed to have

minimal impact on other traffics thereby minimizing congestion.

2) Detour Plan during Construction

Basic policies with regard to detour during construction are set as below;

- A detour that minimizes the impact on general traffic will be considered
- Make optimum use of the existing roads and minimize the number of detour
- The north and south roundabout ends should be as wide as possible to ensure smooth traffic
- Change signalized intersection and roundabout necessarily

The proposed detour is illustrated in Figure 2.2-27.

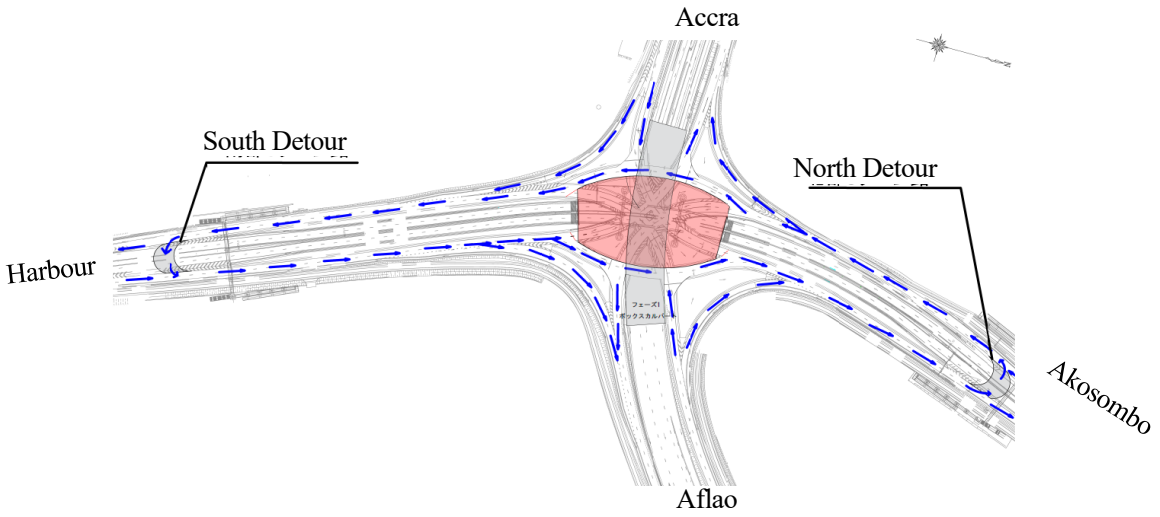


Figure 2.2-27 Proposed Detour

2.2.4.3 Scope of Works

The responsibilities to be borne by Japan and the Republic of Ghana are summarized in Table 2.2-36.

Table 2.2-36 Responsibility of Each Government

Items	Contents/Requirements	Responsible Country		Items
		Japan	Ghana	
Street lights and signals	Power supply		✔	
Materials	Procurement and transport of material	✔		Specific material will be procured from Japan
	Customs clearance	✔	✔	
Preparation Works	Securing of land required for construction		✔	Project Office, Accommodation Construction Yard
	Others	✔		
Removal/Relocation of utilities	Relocation of Obstruction		✔	Water pipe, electric cable, communication cable, sign board
Main Construction	Road, bridge works, retaining walls, ancillaries	✔		Steel bridge, Sub-structure, pavement, drainage structures, street lights, traffic signals, safety facilities

2.2.4.4 Consultant Supervision/Procurement

Basically, the Japanese Consultant will enter into an agreement with the Republic of Ghana to request their support for the bidding activities and the construction supervision.

(1) Detailed Design

The major works to be carried out by the detailed design consultant are as follows:

- Undertake consultations with concerned authorities of Ghana and carry out field surveys,
- Detailed design and drawings preparation
- Project cost estimate

  The duration to carry out the detailed design work is about 2.5 months.

(2) Bidding Assistance

The major tasks to be undertaken between the time of inviting contractors to bid and the time for signing of contract for construction includes:

- Preparation of bid documents (in parallel with the detailed design).
- Bid announcement
- Pre-qualification of bidders
- Bidding
- Evaluation of bid documents
- Preparation of Contract Agreement

The duration of the bid-related activities is about 5 months.

(3) Construction Supervision

The Consultant will supervise the Contractor's planning and implementation of the construction contract. The major tasks under this stage include:

- Verification/Approval of related surveys and quantities
- Review/Approval construction plans
- Quality Control
- Process Control
- Work Output Control
- Safety Management
- Taking-over Inspection and Acceptance

The duration of construction supervision is approximately 29 months. The construction supervision team shall consist of: 1-Resident/Chief Engineer (Japanese), 1-Site Inspectors (Local), 1-Clerk of Works (Local).and 1-Utility Personnel (Local). A bridge engineer would be dispatched at the time of bridge erection. A safety control officer is necessary to supervise, talk and cooperate with a construction contractor's safety manager so that occurrence of an accident may be prevented.

2.2.4.5 Quality Control Plan

The tasks to be carried out for quality control during the construction period are as follows:

- Bridge Erection Works
- Concrete Works
- Reinforcing Bars and Formworks
- Earthwork
- Pavement Works

Based on the above, the quality control of main items for Steel works and concrete works are presented in Table 2.2-37 and Table 2.2-38 and for earthwork and pavement as provided in Table 2.2-39.

Table 2.2-37 Quality Management Plan for Flyover (Bridge) Superstructure

Item	Test Items	Test Method	Inspection Contents and Timing
Structural Steel	Mill sheet and inspection reports	JIS G 3101, JIS G 3106, JIS G 3140	Confirmation of specification of steel and collate with the product before delivery(shipping)
Painting	Paint	JIS K 5551, JIS K 5552, JIS K 5553, JIS K 5659	Confirmation of specification of steel and collate with the product before delivery (shipping)
	Coating/ Film thickness Inspection	C-5 paint (Anti-corrosion of Steel Bridge Handbook)	During every coating
Fabrication of Steel	Welding test, penetrant flaw detection, X-rays	JISG3106 or equivalent	Material test (tensile, bending, impact tests), groove welding test, Fillet welding test, Rigidity test
	Temporary assembly		Joint inspection and approval by consultant
Field Erection	Erection Inspection	Specifications for Highway Bridges to be followed	Confirmation of camber, splices, bearings and temporary assembly under the presence of a consultant
	High tensile bolt		Confirmation of specification of steel and collate with the product before delivery (shipping)
	Erection completion inspection		Confirmation of camber, alignment, bearing after erection and removal of supports etc. under the presence of a consultant.
Field painting	Material adjustment		
	Acceptance inspection	JIS K 6251 or equivalent	Prior to delivery (shipping)
	Paint	JIS K 5551, JIS K 5552, JIS K 5553, JIS K 5659	Confirmation of specification of steel and collate with the product before delivery (shipping)
	Coating/ Film thickness Inspection		Confirmation of management record and sampling inspection
	Finishing		Confirmation of color, appearance
Bearing	Product, installation, completion		Confirmation of quantity before shipping, confirmation of installation after completion, After casting of concrete, checking condition/finishing of bolts and filling of non-shrink mortar
Expansion joint	Acceptance inspection	JIS B2352 or equivalent	Similar to bearing
Drainage	product		Prior to delivery (Shipping)

Table 2.2-38 Quality Management Plan of Concrete Works

Item	Test Items	Test Method	Test Frequency
Cement	Cement Property/Physical Test	AASHTO M85	Once before trial mix and once every 500 m^3 batch; or once during production of cement (Mill sheet)
Aggregate	Property/Physical Test	AASHTO M6	Once before trial mix and once every 500 m^3 batch; and all changes of quarry source/location (check supplier data)
	Property/Physical Test	AASHTO M80	Once before trial mix and once every 500 m^3 batch of concrete; and every change of source/quarry location (check supplier data)
	Sieve Analysis	AASHTO T27	Once a month
	Alkali-silica Reactive Test(Mortar Bar Method)	ASTM C1260	Once before trial mix and every change of source/quarry location (check supplier data)
	Mineral Composition Test	ASTM C295	Once before trial mix and every change of source/quarry location (check supplier data)
Water	Water Quality Test	AASHTO T26	Once before trial mix and when necessary
Admixture	Quality Test	ASTM C494	Once before trial mix and when necessary (Mill Sheet)
Concrete	Slump Test	AASHTO T119	Once every 75 m^3 or per batch
	Air Content Test	AASHTO T121	Once every 75 m^3 or per batch
	Compressive Strength Test	AASHTO T22	6 Samples per batch or 6 samples for every 75 m^3 of concrete (3 samples each for 7-day strength and 28-day strength)
	Temperature	ASTM C1064	Once every 75 m^3 or per batch

Table 2.2-39 Quality Management Plan for Earthwork and Pavement Work

Item	Test Items	Test Method	Test Frequency
Embankment	Density Test (Compaction)	AASHTO T191	Every 500 m^2
Base course	Material Test (Sieve Analysis)	AASHTO T27	Once before placing and once every 1,500 m^3 or change in source/quarry location.
	Material Test (CBR Test)	AASHTO T193	Once before placing and once every 1,500 m^3 or change in source/quarry location.
	Dry Density Test (Compaction)	AASHTO T180	Once before placing and twice every 1,500 m^3 or change in source/quarry location.
	Field Density Test (Compaction)	AASHTO T191	Every 500 m^2
Asphalt paving	Material Test (Sieve Analysis)	AASHTO M43,M80	Once before placing and once every 1,500 m^3 or change in source/quarry location.
	Material testing (density and percentage of absorption).	AASHTO T84	
	Density-in-situ examination.	AASHTO T209	Every 200m
	Temperature survey		Every track
Modified asphalt paving	Marshall stability test	ASTM D 1559-89	Design stage:5 samples per mix, 3 pieces = 15 times Trial mix stage: : 3 samples per mix, 3 pieces= 9 times Paving stage: Once before placing
	Dynamic Stability Test	Measurement of plastic deformation by Wheel Tracking Machine	At Trial Mix: Once per 1 mix At Construction : Once per paving asphalt of 1,000 ton
	Other test	JIS	as may be necessary

2.2.4.6 Procurement Plan

The major construction materials and equipment to be procured, based on field research for procurement, are mentioned below.

(1) Procurement of Major Construction Materials

1) Procurement of Materials related to Steel Bridge

Since steel materials used for bridge members are special steel materials using Japanese technology, it is difficult to procure them in Ghana. Therefore, the steel materials will be procured from Japan.

2) Procurement of Ready-mixed Concrete

Ready-mixed Concrete for the retaining wall and substructure of the bridge shall be procured from the local concrete plants located around the project site. A photo of concrete plant near the project site is Photo 2.2-1.

3) Procurement of Asphalt Concrete

There are several asphalt plants within the distance that can be procured.

4) Procurement of Base and Subbase Materials

Base and subbase materials shall be procured from quarrying plant located at Shai Hill on Akosombo road. Photo 2.2-2 shows the plant in production, and Figure 2.2-28 shows the location of borrow pit and aggregate plant.

Photo 2.2-1 Concrete Plant in Production

Photo 2.2-2 Quarry Plant in Production

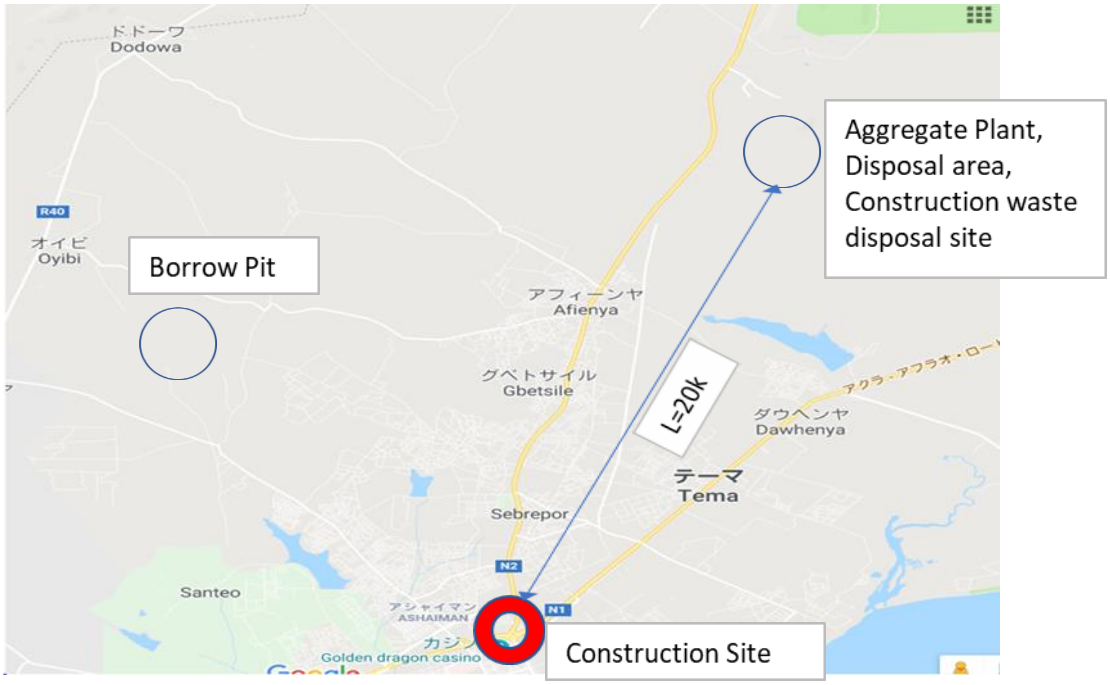


Figure 2.2-28 Location of Borrow Pit and Aggregate Plant

5) Procurement Area of Major Construction Materials

Procurement area of major construction materials are summarized into Table 2.2-40.

Table 2.2-40 Procurement Area of Major Construction Materials

Items		Procurement Area			Procurement Reason	Procurement Routes Local
Item Name	Description	Local	Japan	Third Country		
Materials for Steel Bridge			✔		Special Steel	Marine transport from JP
Rebar	D13-D32	✔				Near construction site
Concrete	20-40N/mm^2	✔				Near construction site
Base Course	Graded crushed stone	✔				Aggregate Plant (L=20 km)
Sub-base Course	Crushed stone	✔				Aggregate Plant (L=20 km)
Fill Material	Sand	✔				Borrow Pit in Shai Hill
Asphalt		✔				Near construction site
MSE Wall				✔	Cost effective	South Africa
Liner Plate	ϕ =2.5 m, 5.0 m		✔		Not available (N/A) in Ghana	Marine transport from JP
Painting Material			✔			Marine transport from JP
Steel bearing			✔			Marine transport from JP
Expansion Joint			✔			Marine transport from JP
Fuel		✔				Near construction site
Wooden form		✔				Accra
Plywood		✔				Accra

Items		Procurement Area			Procurement Reason	Procurement Routes Local
Item Name	Description	Local	Japan	Third Country		
Steel for temporary works	H-steel		✔		N/A in Ghana.	Marine transport from JP
Support	Supported frame	✔				Accra
Rubber bearing			✔		Ensure quality assurance and on-schedule delivery	Marine transport from JP
Sealing and Bonding			✔			Marine transport from JP
Sealing strip (water stoppage)			✔			Marine transport from JP
Traffic Signal			✔		Difficulty in local procurement	Marine transport from JP

6) Procurement of Special Materials

Special materials which can not be procured in Ghana include rubber bearing and joint material for approach cushion slab, sealing and bonding materials, waterproofing materials, and traffic signals. These materials shall be procured in Japan.

・ Procurement of Materials related Steel Bridge

Steel materials related steel bridge is special materials using Japanese technology, hence the materials will be procured from Japan.

・ Rubber Bearing and Igus

The rubber bearing is an apparatus that transmits the load from the approach slab to the abutment. Igus is a device that connects the abutment and the approach slab, and serves as a buffer against shaking and dislocation of approach slabs. Both the bearing and the Igus are important materials for prolonging durability. In Ghana, these are imported from foreign countries, but it is judged that procurement from Japan is appropriate for ensuring quality and timely and soundly delivery.

・ Water-stopping (preventing) Materials

A sealing strip or water stoppage (waterproof sheet) will be installed because water seepage and leakage from the bottom plate of the L-type retaining wall and the joints on the side walls are assumed. The general items in Ghana can be procured, but there are concerns about quality and delivery time. In Japan, stock is sufficient and reliable procurement including delivery deadlines are ensured.

・ Cushion Drum

This is not locally available and will be procured from Japan.

(2) Procurement of Major Construction Equipment

Photo 2.2-3 shows major construction equipment which can be procured from local contractors and leasing company.

Concrete pump vehicle

Concrete mixer vehicle

Bulldozer

Backhoe & road roller

Backhoe and Bulldozer

Photo 2.2-3 Major Construction Equipment to be Procured

Construction equipment to be procured is summarized in Table 2.2-41.

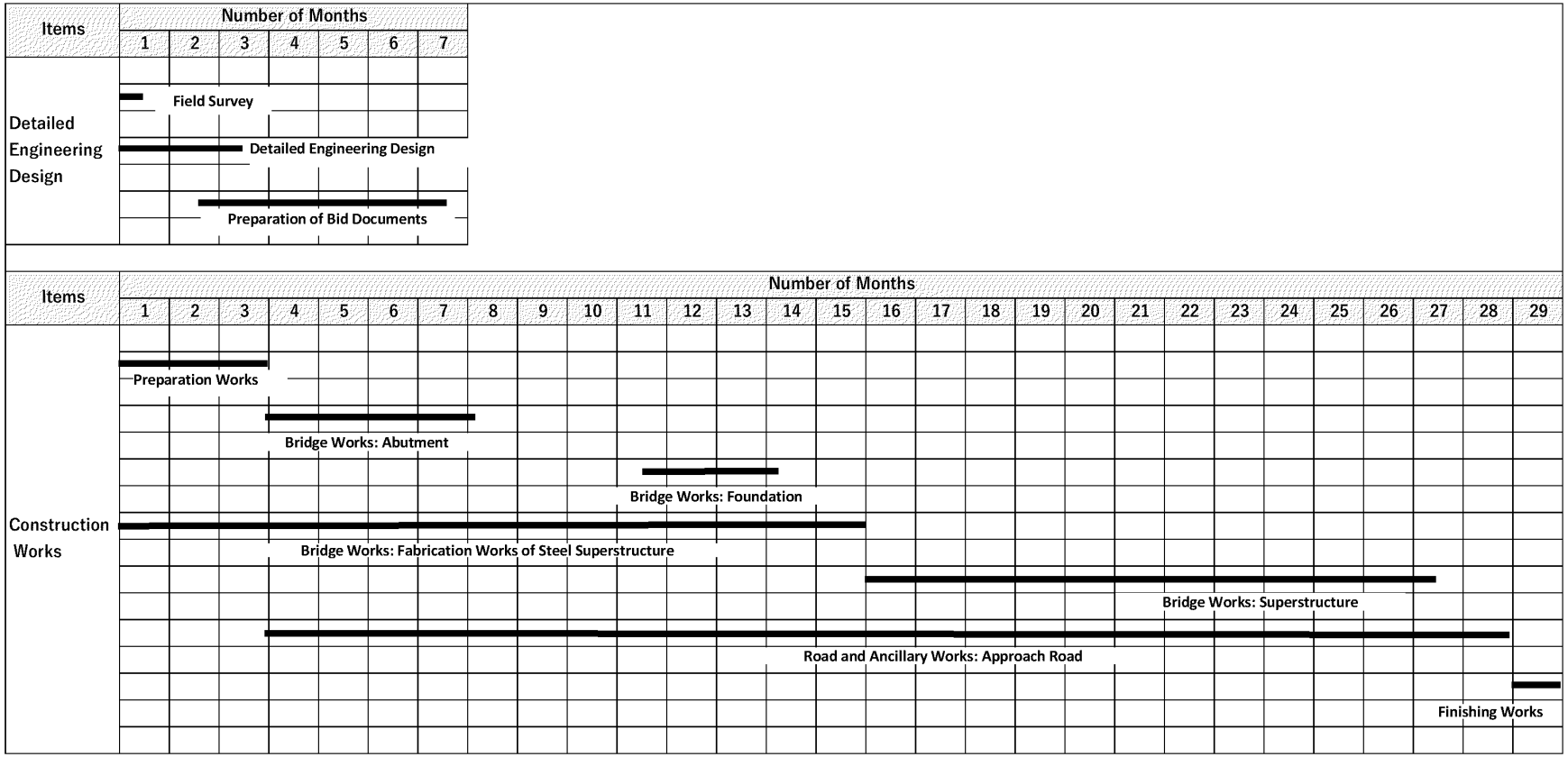
Table 2.2-41 Major Construction Equipment to be Procured

Item		Purchase/ Rent	Procurement			Reason	Procurement Routes
Item Name	Description		Local (Ghana)	Japan	Third Country		
Backhoe	0.45 m^3	Rent	✔				Accra
Backhoe	0.8 m^3	Rent	✔				Accra
Backhoe	1.4 m^3	Rent	✔				Accra
Dump Track	10 t	Rent	✔				Accra
Dump Track	4 t	Rent	✔				Accra
Bulldozer	21 t	Rent	✔				Accra
Bulldozer	15 t	Rent	✔				Accra
Tire Roller	8-20 t	Rent	✔				Accra
Road Roller	10-12 t	Rent	✔				Accra
Motor Grader	W=3.1 m	Rent	✔				Accra
Truck Crane	16-25 t	Rent	✔				Accra
Truck Crane	45-300 t	Rent	✔				Accra
Concrete Breaker	600-800 kg	Rent	✔				Accra
Vibrator Roller	Riding Type 3-4 t	Rent	✔				Accra
Water Pomp	φ100 mm, 15 kw	Rent	✔				Accra
Diesel Generator	22 KVA	Rent	✔				Accra
Truck		Rent	✔				Accra
Bulldozer		Rent	✔				Accra
Rough Terrain Crane		Rent	✔				Accra
Concrete Pump		Rent	✔				Accra
Paver		Rent	✔				Accra
Line Marker		Rent	✔				Accra

2.2.4.7 Implementation Schedule

Table 2.2-42 presents the implementation schedule of detail design and construction period.

Table 2.2-42 Implementation Schedule of Phase-2 of the Project



2.3 Security Plan

The safety plan is prepared in accordance with the ODA Construction Safety Management Guidance (September 2014). The detailed design and supervision consultant together with GHA will check the safety plan prepared by the contractor and provide comments and instructions for any improvement required. The safety plan will consist of, but not limited to;

1. Safety policies
2. Safety management system
3. Promotion of plan-do-check-act (PDCA) cycle
4. Monitoring
5. Education and trainings on safety
6. Voluntary safety management activities
7. Disclosure and sharing of information
8. Response plan in case of emergency and occurrence of unanticipated events

2.4 Obligations of Recipient Country

The undertakings required from the GOG for the smooth execution of this project are as follows:

- To provide documents, data and information necessary for the execution of this project;
- To acquire land for construction yard;
- To secure land for construction yard, stock yard, disposal area for construction debris, site office yard, and detour routes;
- To secure borrow pits, spoil-banks, and industrial waste disposal areas;
- To obtain all necessary permits, to coordinate and share necessary information with concerned organizations regarding the method of road occupancy of the Motorway, procedure for allowing public vehicles, traffic restrictions, and day-time, night time works;
- To get the public informed and take necessary steps before hand regarding blockage of road for public vehicles during relocation of overhead facilities such as traffic signs;
- To coordinate with concerned organizations and agencies in charge of underground utilities pertaining to its protection, reinforcement / repair and to pre inform all road users and local inhabitants in case disruption of water and electricity are anticipated;
- To coordinate with concerned organizations and agencies in charge of street lights and electronic traffic signs regarding its protection and/or its relocation and to take necessary steps to inform road users beforehand in case disruption of electricity is anticipated;
- To obtain necessary permits that would allow the personnels engaged in the construction work such as the supervision engineer, construction workers etc. to access ROW;
- To obtain necessary permits to allow the construction vehicles/ equipment enter and exit the ROW;
- To bear the cost of bank charges such as the Advising Commission and Payment Commission to the Japanese bank where an account related to the project is opened;
- To bear the value-added-tax related to the project;
- To bear all expenses required for 15% of VAT (Value Added Tax);
- To bear all expenses required for 2.5% of NHI (National Health Insurance);
- To assist in the process for exemption of materials imported for the construction work from taxation and Customs clearance in order to ensure smooth inland transportation;
- To assist in the process for exemption of Japanese nationals engaged in the construction work from Customs duties and other fiscal levies on products and services necessary for the execution of the project;
- To assist in the process for exemption of Japanese nationals from all legislation measures necessary for entering and staying in the Republic of Ghana;
- To ensure proper use and maintenance of the road after its construction;
- To cooperate in solving potential troubles with the local people or any third party in connection with the execution of the project;
- To bear all expenses required for the execution of the project, other than those borne by the Grant-Aid of Japan.

2.5 Project Operation Plan

2.5.1 Organization for Operation and Maintenance

2.5.1.1 Organizational Framework

Roads in Ghana are administered by the Ministry of Roads and Transport (MRT) through three agencies namely Ghana Highway Authority (GHA), Department of Feeder Roads (DFR) and the Department of Urban Roads (DUR).

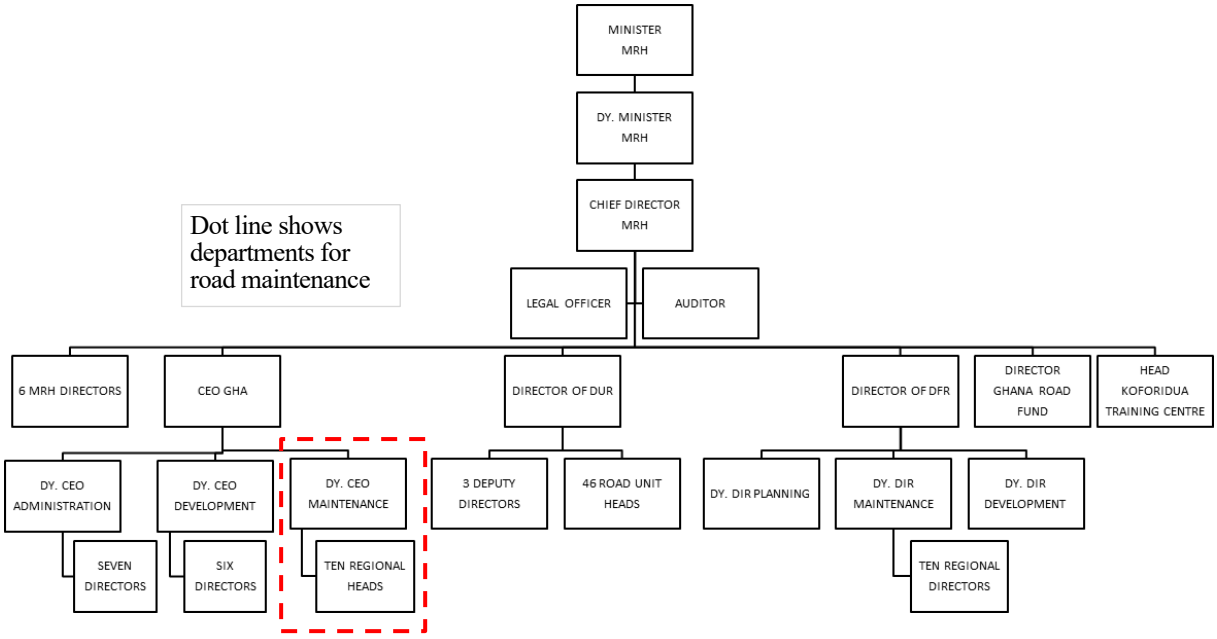


Figure 2.5-1 Organizational Framework of MRH

As shown in Figure 2.5-2, Maintenance Department which has 10 regional heads nationwide (Table 2.5-1) is responsible for road maintenance.

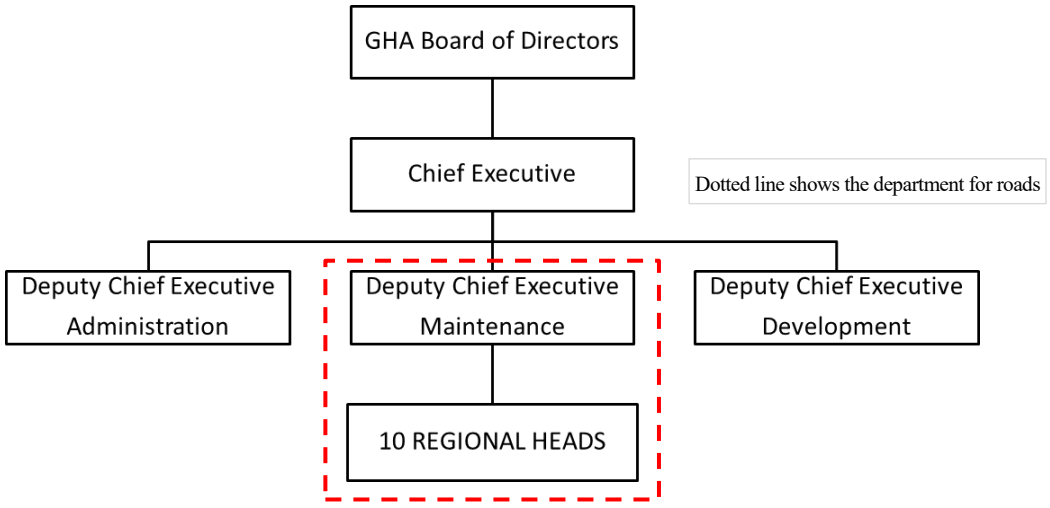


Figure 2.5-2 Department in Charge of Maintenance in GHA

Table 2.5-1 Regionals Heads of Maintenance Department

Northern Sector	Upper East Region Upper West Region Northern Region Brong Ahofo Region Ashanti Region
Southern Sector	Eastern Region Central Region Western Region Great Accra Region Volta Region

Regional Heads are operated as shown in Figure 2.5-3.

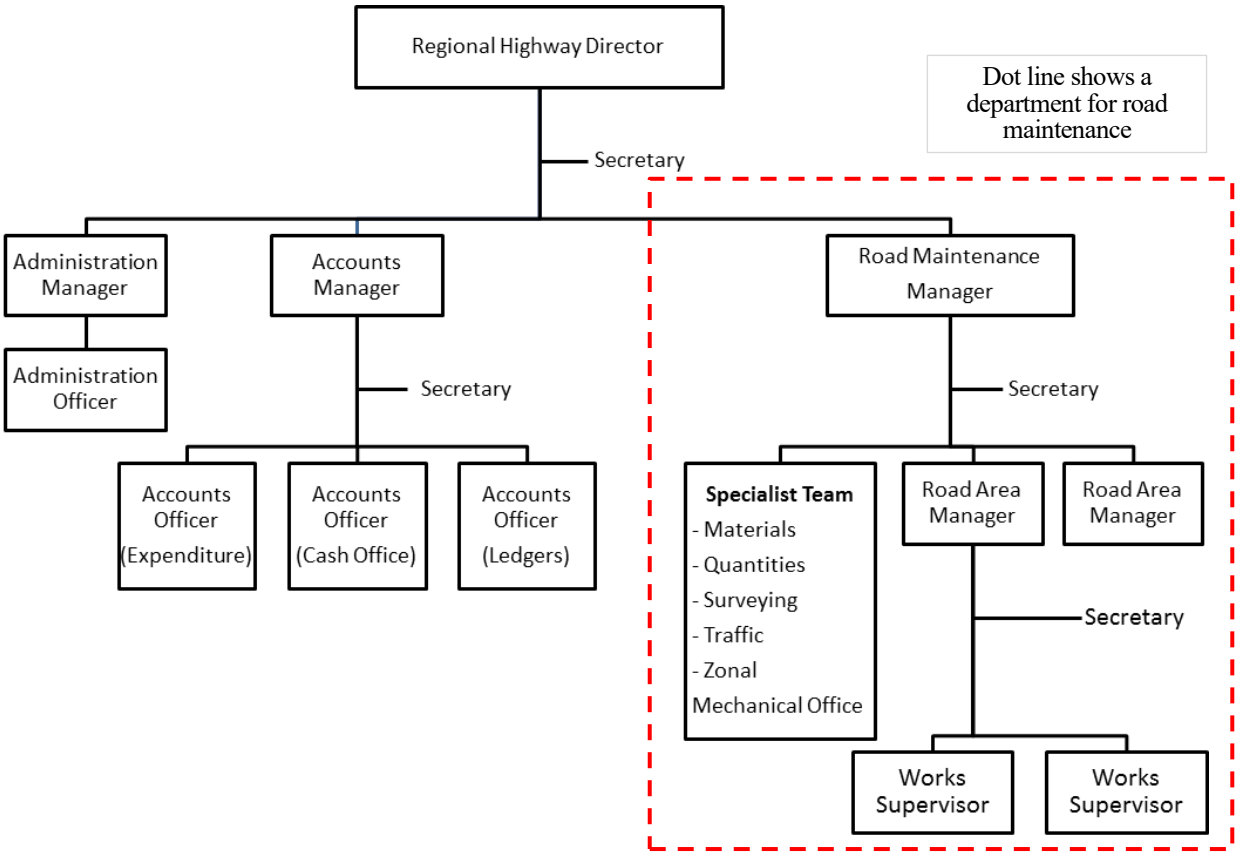


Figure 2.5-3 Organization of Regional Head

For purposes of maintenance in the regions, each region is divided into GHA Road Areas, the number and size of each depending on the number and geographical spread of projects in the region.

Road Areas shall have the three primary responsibilities of;

- Collecting road data,
- Inspecting roads, and
- Supervising road maintenance

Table 2.5-2 GHA Road Areas

Region	No. of Areas	Covered Areas
Ashanti Region	3	Kumasi, Mampong, Bekwai
Eastern Region	4	Koforidua, Oda, Nsawam, Nkawkaw
Volta Region	3	Ho, Hohoe, Keta
Central Region	3	Cape Coast, Dunkwa, Winneba
Western Region	3	Takoradi, Tarkwa, Wiawso
Greater Accra Region	1	Accra
Brong-Ahafo Region	4	Sunyani, Goaso, Kintampo, Atebubu
Northern Region	4	Tamale, Yendi, Gambaga, Saula
Upper East Region	1	Bolgatanga
Upper West Region	2	Wa, Tumu
Total No. of Road Areas	28	

Each Region has a Special Team made up of personnel with specialization in materials, topographic surveying, traffic and quantity surveying. Greater Accra Region is responsible for the road maintenance for the project

2.5.1.2 Road Sector Personnel in GHA

Table 2.5-3 shows road sector personnel in GHA by Staff Category as of 2015.

Table 2.5-3 Road Sector Personnel in GHA

Staff Category	Male	Female	Under 30	30-40	40-50	50-60	Over 60	Total
Directors	30	2	-	-	7	25	-	32
Engineers	139	16	41	37	30	47	-	155
Quantity Surveyors	22	2	1	8	6	9	-	24
Economists	1	1	-	1	-	1	-	2
Technicians	155	11	18	48	17	83	-	166
Planners (Valuers)	4	-	-	2	-	2	-	4
Accountants	115	35	2	15	15	118	-	150
Administrators	28	69	7	10	11	69	-	97
Drivers	206	0	5	48	42	111	-	206
Others	801	215	173	182	128	533	-	1,016
Total by Age	1,501	351	247	351	256	998	-	1,852

2.5.2 Contents of Operation and Maintenance

Road maintenance work conducted by GHA is shown below. Most of the works are done by subcontracting.

- Pavement repair
- Road structure repair
- Cleaning on pavement surface and drainage

- Planting
- Traffic signal and street lighting
- Bridge inspection and repair

2.5.3 Points to Consider in Road Operation and Maintenance

To realize full benefits of the project and its facilities, and to sustain its operation and keep it in good driving condition, it is important to improve its durability. In addition, the objective road is as the full access controlled motorway hence it is of great significance to secure the highway characteristics which matter most to the driver which includes speed of travel, safety, comfort, and convenience, and also implementing facility maintenance related to road functional management, traffic management and safety management. The following needs should be noted:

- Inspect the facility regularly to abreast with its condition at all times
- Regular cleaning of road and incidental road facilities – especially drainage system
- Implementing regular facility inspection, cleaning and maintenance related to road functional management, traffic management and safety management
- Secure budget necessary for maintenance

With that in mind, it is important to allocate budget for operation and maintenance.

2.5.4 Gender Equality Approach

Gender equality is an idea to eliminate gender-based discrimination. In the employment environment, it will be promoting equal opportunities, equal working conditions and soundness of working environment through consideration for women who are vulnerable to social disadvantages. This section focuses on the promotion of women's active participation at construction sites.

2.5.4.1 Labour law in Ghana

Laboure Act, 2003 in Ghana shows the regulation for pregnant woman in section 55-57 of Part VI "Employment of Woman".

55. Night work or overtime by pregnant women
56. Protection of assignment of pregnant women
57. Maternity, annual and sick leave

2.5.4.2 Assessment on International Agency

World Bank has published the report of "WOMEN, BUSINESS AND THE LAW 2019: A DECADE OF REFORM" in 2019, it was comparing the equal opportunities, equal working conditions for woman on each country. In Table 2.5-4 show a part of the comparison results. Ghana is positioned in middle class in the world, and high class in African countries.

Table 2.5-4 Woman, Business and the Law index scores (a part of result)

Rank	Economy	WBL2019 Score	Rank	Economy	WBL2019 Score
1	Belgium	100	65	America	83.75
1	Denmark	100	83	Japan	79.38
1	France	100	100	China	76.25
1	Latvia	100	103	Cambodia	75
1	Luxembourg	100	103	Ghana	75
1	Sweden	100	103	Honduras	75
37	Taiwan	91.25	103	Thailand	75

2.5.4.3 Japanese Case Study regarding Equal Opportunities, Equal Working Conditions for Woman

In Japan, "Act on Promotion of Women's Participation and Advancement in the Workplace" was established in August 2015, efforts by various actors have been carried out in order to promote women's participation in the construction industry and construction sites.

(1) Promotion by Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

MLIT have shown four (4) promotion packages regarding "construction industry active of woman" below.

1) "construction industry where active of woman" promotion on local and co-work
2) Development of next-generation female leaders on construction industry
3) Model construction site where more active of woman
4) Multi-industry cross-platform supporting women

These promotions aim equal opportunities at construction industries and establishing of proper work environment and work life balance. Also, MLIT has studied the woman ratio in this industry, which is as shown in Table 2.5-5.

Table 2.5-5 Working ration of woman in construction industry

Items	Ratio (%)
Working ration of woman	13.0%
Engineer	4.5%
Expert	4.2%
Manager	3.5%

(2) Japan Federation of Construction Contractors

1. Preparation of compatible working environment for women
2. Practice of compatible working environment for women (management)
3. Preparation of supporting facilities for Childbirth and childcare
4. Practice of supporting facilities for Childbirth and childcare (management)

Especially, part 1 is useful to show many concrete ideas for proper working environment.

(3) JICA's Initiation

JICA has in its proposal evaluation system started giving account to the efforts of firms that has been aggressive in employment of females and participation of females in JICA projects.

2.5.5 The Policy on Gender Consideration in Phase-2

2.5.5.1 Involvement of Female Engineers in Main Contractor's Firm

The project is implemented under the grant aid scheme of Japan. General procedure of selection of contractors covers pre-qualification, confirmation of technical and financial bid. Pre-qualification is not used to judge superiority, but to assess whether the companies are qualified or not. On the other hand, bidding is just evaluation of the bidding price, and is not assessment of the qualification of a company. Considering these circumstances, consideration for gender is proposed as shown in Table 2.5-6.

Table 2.5-6 Gender Consideration Policy

Category	Item	Expecting outcome	Concerning
PQ condition	Requiring to preferential system of women such as "Kurumin", "Eruboshi".	・ It can confirm gender consideration as company	・ Uncertain the participation to actual construction site ・ Concerns about the adequacy of applying the system
Tender document	Requiring of women's ratio in Personnel dispatch schedule	・ Assure the ratio of participation of woman in construction site	・ Difficult to appropriate indicator for ratio of woman's engineer ・ In the case of set to women's ratio in major engineering assignment, it may limit business contractor
	Obligation to setup female's toilet and dressing room	・ Indirectly encourage female employment	・ It cannot separate during engineer and non-engineer ・ Actual participation of women engineers in not assure even there is facilities.
	Educational duties for staff regarding gender considerations	・ Consideration for the working environment for women by reforming awareness on the male side	・ Nothing
Tender price	When the ratio of women engineer in the construction site is more than a certain number, evaluate the bidding amount by adding a certain devaluation	・ It will be a motivation to promote active participation of women by contractor	・ Influencing to bidding amount, it will be difficult as considering E/N price.

As the results of above consideration, three policies regarding gender consideration policy are proposed.

Gender consideration policy:
1) Obligating to setting the female's toilet and dressing room
2) Requiring to 5% women's ratio of engineer in tender document
3) Educational duties for staff regarding gender considerations in tender document

2.5.5.2 Involvement of Female Engineers in Sub-contracting Firms

It is assumed that many subcontractors will be engaged in the construction during Phase 2. Subcontractors include suppliers of equipment and companies that undertake the subcontract for delivery of materials and equipment. The degree of involvement for each job is also different. For this reason, it is not reasonable to give the sub-contractor a uniform ratio of female participation.

In Phase-1, number of females engaged in construction work is virtually null (zero) although there were few

women undertaking field works under the sub-contractors. The construction companies say it has not set employment conditions that are favorable to males and has rather been open for female participation also, but application from women seem to be negligible.

Sub-contractors are managed by contracts with bidders (contractors). Interventions that affect the selection of sub-contractors are far from the actual construction industry in Ghana and prevent appropriate competition. Judgment should be avoided as it may interfere fair and square competitive grounds.

For this reason, with regard to sub-contractor or on-site female work, a policy limiting to promotion of voluntary based understanding and realizing the actual situation is set.

2.5.5.3 Involvement of Female in the Project

The consultant who supervises the Project is involved in the detailed design (DD) and construction supervision (SV) of the project.

(1) The Policy on Detail Design Stage

Many members of the preparatory survey will continue to be involved in the detail design. Currently, 11 members of the Phase 2 Preparatory Survey are dominated by male members, and only local employment secretaries are women. Many members of the preparatory survey stage are assigned to the detail design stage. There is only one female working during the preparatory survey stage but as a project coordinator.

However, during the detailed design, as most of the work is done in Japan, a policy is set that asks for active involvement of females. It is thus proposed that the target for involvement of women during the detailed design is set to 10% of the total man-month.

(2) The Policy during Construction Supervision Stage

Construction supervision is normally carried out by a few persons. The resident engineer of Phase-1 is a male engineer and it is very likely that the same person will work as the resident engineer for Phase-2. However, 0.5 man-month involvement of a female engineer for spot supervision should be set as a striving target.

(3) Involvement of Women from GHA

Table 2.5-7 is the list of organizations related to the project including personnel that were met for meetings or hearings with regards to Phase-2 survey. Females in the list account to more than 10% , which is relatively higher compared to the ratio of females employed by the consultants, the contractors and the sub-contractors.

Table 2.5-7 Client Staffs Involvement in Phase-2

#	Organization	Designation	Name
1	Ghana Highway Authority	Chief Executive	Mr. Ernest Arthur
2		Deputy Chief Executive	Mr. Amin Baba Kassim Nuhu
3		Director of Planning	Mr. S. D. Addo
4		Director of Contracts	Mr. David A. Hammond
5		Director of Survey & Design	Mr. E.A. Mills
6		Director of Quantity Surveying	Mr. Hayford Buabeng Kyeremah

#	Organization	Designation	Name
7		Ag. Director of Bridges	Mr. Yaqub Koray
8		Strategic Planning, M&E Manager	Mr. Shelter Y. Lotsu
9		Project Coordinator	Mrs. Mercy Akyaa Payne
10		EMU Manager	Mrs. Rita Ohene Sarfoh
11		Senior Environmental Officer	Mrs. Hilda Annan
12		Highway Design engineer	Mr. Bernard Owusu
13		Engineer	Mr. Divine Kehodu

In Ghana, the person in charge of the relevant position plays an active role regardless of gender in meeting with the parties concerned or solving problems when proceeding with the project. The degree of involvement in actual projects is also unevenly distributed by position. In light of these circumstances, instead of setting a threshold of ratio with regards to female involvement, it is rather suggested that measures to encourage active participation and put forward frank remarks are recommended.

More specifically, 1) provide opportunities for women staffs to participate in the meetings 2) encourage such participants for putting forward opinions,etc. In case of the Client side, these two points are as targets to promote female involvement and promotion of female status.

2.5.5.4 Promotion on participation of women staff in JICA

Percentage of women's staff in JICA is around 30%, and working staff in overseas is around 25%. In light of these circumstances, JICA aims to involve more than 30% of women staffs in this project.

2.5.5.5 The monitoring of gender consideration

Basically, the monitoring results will be reported in each half year by consultants as shown in Table 2.5-8.

Table 2.5-8 Monitoring method on participation of women

Duration	Organization	Target	Goal	Summary
Detail design	JICA	Main staff in Head office and regional office	more than 30% women's staff based on assigned schedule in this project	・ Consultant will report to JICA in each half year
	Consultant	Engineer assigned in this project	more than 10% women's engineer based on MM	same of above
	Client	Participant ratio in main meeting	Existence or nor of comment	same of above
Supervising construction	JICA	Main staff in Head office and regional office	more than 30% women's staff based on assigned schedule in this project	・ Consultant will report to JICA in each half year
	Consultant	Engineer for spot management	more than 5% women's engineer based on MM	same of above
	Client	Participant ratio in main meeting	Existence or nor of comment	same of above
	Contractor	Engineering staff in Ghana	more than 5% women's engineer based on MM	・ Contractor share the assignment schedule with consultants in each half year ・ Consultant share it with JICA and Client
	Sub-contractor	Worker in site	No goal, but monitor the participation of women	・ Contractor report to consultant ・ Consultant share it with JICA and Client

2.6 Project Cost Estimate

2.6.1 Initial Cost Estimation

The total estimated cost for implementation of this project amounts to XXXXXXX Japanese Yen. This amount is provisional and is the amount of the Grant. This amount is subject to examination further by the Government of Japan for approval of the Grant.

The estimated project cost is the total of contributions to be made by both governments of Japan and Ghana and consists of items explained in next sections. These costs have been calculated based on the cost estimate conditions mentioned in Section 2.6.1.3.

2.6.1.1 Japan's Contribution

The approximate amount estimated for contribution from Japan is as shown in Table 2.6-1.

Table 2.6-1 Approximate Cost Estimate of Japanese Contribution

Item		Amount

2.6.1.2 Ghana's Contribution

The approximate amount estimated for contribution from Japan is Table 2.6-2 Ghana Cedis.

Table 2.6-2 Approximate Cost Estimation of Ghana Contribution

Item	Amount (GH₵)
Bank Charge	300,000

2.6.1.3 Cost Estimation Condition

Project cost is estimated in below condition.

Cost Estimation Date	February 2019
Foreign Exchange Rate	GH₵1.00＝23.04 JPY US$1.00=112.67 JPY
Construction Period	Schedule of construction supervision is shown in the implementation schedule
Others	The project is carried out based on the Japanese Government's Grant Aid Scheme.

2.6.2 Operation and Maintenance Cost

Table 2.6-3 represents operation and maintenance cost for the major works. Since operation and maintenance works are conducted by subcontracting, there are no technical problems on maintenance work.

Table 2.6-3 Maintenance Item to be checked and Annual Maintenance Cost

Category	Facility Name	Items to be checked	Frequency	Personnel	Equipment	Total Number	Cost (1,000 GH₵)
Periodic Inspection	Pavement	Crack etc.	4 times/year 5 days/time	2 persons	Scoop/Hammer/ Sickle/Barricade	40 persons/year	2.66
	Drainage	Sediment Deposition/Obstacle					
	Box Culvert / Retaining Wall	Damage/Deformation/Peeling etc.					
	Traffic Safety Facility	Reflector, Crash Barrier, etc.			Pickup	20 vehicles/year	12.58
	Subtotal						15.24
Routine Maintenance	Pavement	Cleaning	4 times/year 5 days/time	10 persons	Scoop/Barricade	200 persons/year	24.09
	Drainage	Removal of Obstacle or Sediment					
	Bridge/ Footbridge	Cleaning			Small Truck	20 vehicles/year	12.58
	Subtotal						36.68
Repair	Pavement	Crack etc.	2 times/year 7 days/time	6 persons	Worker	84 persons/year	3.44
	Drainage	Damaged part etc.			Plate Compactor	14 vehicles/year	10.15
	Box Culvert / Retaining Wall	Damaged part etc.			Small Truck	14 vehicles/year	9.45
	Traffic Safety Facility	Damaged part etc.			Roadbed Material	50.0 m3/ year	3.7
	Median	Crack etc.			Asphalt	10.0 t/ year	7.52
	Reflector	Crack etc.			Cement	130 bags/ year	4.72
	Street Lighting	Exchange of Lamp			Cobbled Stone	3.0 m3/ year	0.23
	Bridge/ Footbridge	Damaged part etc.			Lane Marking	50 m/ year	0.35
	Traffic Signal	Exchange of Lamp			Lamp for Traffic Signal	2 lamps/ year	31.92
	Traffic Safety Facility	Damaged part etc.			Lamp for Street Lighting in BOX Culvert	4 lamps/ year	50.29
	Subtotal						121.78
Total							173.70

Note:

1.The maintenance items and the annual maintenance cost covers all the infrastructure including those constructed during Phase-1.

2. Maintenance of bridge (steel girders) are not considered due to application of high-durable paints

3. Project Evaluation

3.1 Preconditions to implement the project

The Project preconditions related to the required undertaking from the Republic of Ghana are as follows:

i) Banking Arrangement (B/A) with a Bank in Japan shall be concluded within one (1) month after the signing date of Grant Agreement (G/A).

ii) The payments will be made when payment requests are presented by the Bank under an Authorization to Pay (A/P). This A/P shall be issued to the Bank that concluded B/A within one (1) month after Consulting Service Agreement is made.

iii) Utility relocation issues are very unlike in Phase-2 as the construction area is strictly in the middle of the Phase-1 premises. Should such utilities nevertheless be identified before the date of formal invitation to Pre-Qualification, such public utilities, like power poles, electric lines/cables, and communication network lines/pipes that will affect the Project works shall be all relocated to the locations where no hindrance and inconvenience shall occur.

iv) Any necessary actions for tax exemption shall be taken keeping to the regulations of E/N and G/A.

v) Quick and smooth customs declaration and import tax formalities shall be completed when the imported materials or goods arrive from Japan and any other third countries.

vi) Should renewal of environment permit is permissible, GHA shall ensure renewal procedures are taken in a timely manner. Throughout the construction period, monitoring Report shall be prepared and submitted to JICA. This Report shall describe monitoring data about such potential natural environmental items as air quality, water pollution, etc. which are more likely to give impacts on the works during construction phase and even after it is completed.

vii) During construction period, eminent assistance shall be given to traffic handling and management plus safety control management.

viii) The power pipes/lines and water supply pipes/lines necessary for the construction work at site shall be routed and installed.

ix) As a means of dispute resolution while the works proceed, discussion and assistance in good earnest shall be made to reach agreement on disputes with people in the vicinity or any other third party around.

3.2 Necessary input by Recipient Country

To derive benefit from the entire Project and to make it sustainable, the necessary input by recipient country is shown as follows.

a) Management and Maintenance

To secure the service life(durability) of pavement, approach road, structure, and other related appurtenant facilities, periodic maintenance inspection or patrol shall be firmly carried out under annual approximate maintenance cost of Ghana Cedis GH₵ 173,700 as shown in Table 2.6-3.

Necessary arrangements shall be done to secure the required budget every year. It is necessary as well to get it repaired appropriately and instantly soon after the damage is discovered. Routine maintenance operations such as cleaning, removal of sediment, debris and obstacles on the road pavement surface or at the drainage facilities shall be done.

This action will bring about further and bigger improvement of road services and more safer transport measures for the road users.

Bearing in mind that regular maintenance, inspection and safety patrol to check the road lights and traffic signals are an absolute must. In terms of sustainable safety performance, daily maintenance inspection shall be performed surely and steadily. It is highly suggested to take consideration into building up the traffic management system to deal with traffic control of left-turn vehicles on the road by way of directing traffic flow by the policeman in case of sudden black-out.

b) Pedestrian Off-Limits at the Intersection

The improvement will be effective if the pedestrians are kept-off from haphazardly crossing the ramps, main carriageways. GOG should raise awareness of the public and take measures to encourage use of footbridges. This action shall require full collaboration with the Police authority.

c) Regulating Illegally Overloaded Vehicles

In Ghana, overloading is controlled on the main national road. From the aspect of ensuring the durability of the bridge and road pavement, stringent regulation of overloaded vehicles is inevitable.

3.3 Important assumptions

The important assumptions of the Project outcome are as described below:

a) Consideration of Building New Bus Terminal

The bus terminal that was confirmed in the northeast of the intersection at the time of the Phase-1 survey was moved to the southeast of the intersection. But this location is temporary. Since there are many users including long-distance buses, it is necessary to install a new bus terminal in cooperation with related organizations in consideration of the convenience of residents in the vicinity.

b) Increase of Traffic Lanes at Accra-Tema Motorway

Eastern and Western Highways passing through Tema Motorway roundabout is regarded to be a part of Accra-Tema Motorway. The Government of Ghana is planning to expand both directions (inbound and outbound) on Accra-Tema Motorway to 6-lanes (3 lanes each side) most probably under PPP Scheme. Feasibility Study on its development is going on. This Motorway is taking up the position of a component of total development plan of ECOWAS, namely, Abidjan-Lagos Highway Development (Trans-Coastal Highway, ECOWAS Highway).

In the top-level governmental conference among the leaders from each concerned country, the idea that design of inbound and outbound 3-lane carriageways all through the distance in Abidjan-Lagos Highway is accepted.

In view of the above circumstances, the adopted structural design requirement for Eastern and Western Highways are to cope with the works for this 3-lane carriageway expansion. Earliest widening to 3-lanes both for inbound lane and for outbound lane on the Eastern and Western Highways is highly expected such that it would contribute in enhancing the project outcome.

c) Improvement of Ashaiman Roundabout

Southern and Northern Highways are linked to Ashaiman Roundabout with 52-meter diameter, located in the distance of approximately 1.5 km north of Tema Motorway Roundabout.

Traffic congestion at Tema Motorway Roundabout comes partly from the current severe congestion at Ashaiman Roundabout. Early commencement of the Project is of importance since the Government of Ghana well understand this Ashaiman Roundabout improvement will turn out to be a good solution to inconvenient traffic flow at Tema Motorway Roundabout. The primary objective of improving heavy congestion at Ashaiman Roundabout is to moderate and ease traffic congestion at Tema Motorway Roundabout.

3.4 Evaluation

3.4.1 Relevance

- 353,000 residents of Tema Metropolitan (estimated in 2000 by Ghana Statistical Service) are direct beneficiaries of the Project. On the other hand, an approximate 86.6 million people is assumed (2015 survey) as users of Tema Motorway Roundabout.
- This Project will contribute to mitigating traffic congestion and securing smooth and safe mobility of pedestrians and freight as well. It is highly expected that this will eventually lead to a comprehensive transport network development for logistics throughout the nation and entire West African Regions.
- Expansion and development of major national integrated arterials covering international transit road as a part of it will be brought about. This Project will be immediately and strongly needed to secure stability of people's lives, development of their livelihood, and securing the BHN (Basic Human Needs).
- Excessively advanced technique is not necessary for this Project. The Government of Republic of Ghana can manage to run, operate and maintain the improved road, related structures, and facilities by using own fund, own local manpower and locally available technical skills.
- National integrated trunk road network system including international transit road as a part will be equally consistent with the policy and target described in the Government National Development Master Plan. This Project can help in achieving enhancement of national trunk road network improvement.
- There is little negative impact upon environmental and social conditions.

- Performing the Project will justify the incentive as well as necessity to utilize Japanese most advanced and cutting-edge construction technology including knowledge with regards to schedule management, safety control, and quality control of a construction project. The project is expected to be implemented under Japan's Grant Aid Scheme without having to face any outstanding issues.

3.4.2 Effectiveness

(1) Quantitative Effect

The expected quantitative effect by the Project is shown in Table 3.4-1. The values of base year (2015) was calculated based on the result of Phase-1 survey. The value of the target year, 2026 which is three year after the completion of the Project, was recalculated in Phase-2 survey.

Table 3.4-1 Quantitative Effect

Index	Basic Value (Actual Record of 2015 year)	Target Value in 2026 (3 years after Completion)
Passenger Volume	86.6(Million)/year	185.7 (Million)/year
Freight (Cargo) Volume	44.3(Million)/year	91.5 (Million)/year
Travel Time (AM peak hour)		
From Accra to Aflao in 2.0 km	8.2 minutes	2.0 minutes
From Akosombo to Harbour in 2.0 km	15.6 minutes	2.0 minutes

(2) Qualitative Effect

The project is expected to bring about qualitative effects as follows;

- Mitigation of traffic congestion and provision of uninterrupted traffic flow
- Stabilization of transportation time from Tema Port
- Improvement of traffic safety of pedestrians and vehicles around the intersection
- Reduction of greenhouse gases emitted from transportation
- Enhancement of connecting links between Coastal Highways (Coastal Corridor) and East Highways (East Corridor)

3.4.3 Impacts to Green House Gas (GHG) and Future Traffic Volume

(1) Current Traffic Volume and Future Traffic Volume

The current traffic volume was calculated using the peak hour traffic count survey conducted in 2019 (Phase-2) and converting it to volume per day by taking the traffic count volume surveyed in 2015 and the growth rates used in the then analysis. The analysis was conducted to examine the traffic capacity during peak hours. For this reason, in order to study the impact on the greenhouse gases, the daily traffic volume is necessary, which requires taking traffic volumes and congestion condition for both the peak hour and off-peak hours into consideration. Baseline is set on the traffic volume of 2015, which will be compared with that of 2035.

(2) Reduction of GHG

1) Prediction Method of GHG Emission Volume

The "Grounds for Calculation of Vehicle Emission factors applied for Evaluation of Environmental Impact Assessment of Road Projects, 2012", which is the Technical Note of National Institute for Land and Infrastructures Management, is referred for prediction of the GHG emission volume. The unit of vehicle emission factor is given for passenger car as per car per 1 km travel, while for other vehicle types it is given by per ton per 1 km travel. For Tema intersection, CO2 emissions by vehicle type were estimated with an average distance of 1 km. Table 3.4-2 gives the emission factor of CO2 for a different types of vehicles. The Estimation on Emission amount of greenhouse gas is calculated the 1 km distance around the Tema junction.

Table 3.4-2 Emission factor of carbon dioxide (CO_2) on representative car type

Average velocity	Gasoline car				Deasel car			
	Passenger car	Freight vehicle☒			Passenger car	Freight vehicle☒		
		Lightweight	Mediumweight	Heavyweight		Lightweight	Mediumweight	Heavyweight
	(g-CO_2/km)	(g-CO_2/km･t)	(g-CO_2/km･t)	(g-CO_2/km･t)	(g-CO_2/km)	(g-CO_2/km･t)	(g-CO_2/km･t)	(g-CO_2/km･t)
5	318.1	295.9	288.7	288.7	461.0	275.5	252.9	128.9
10	235.3	228.9	223.4	223.4	357.1	213.4	195.9	107.6
15	165.5	171.8	167.7	167.0	269.7	161.2	147.9	86.3
20	145.4	153.0	149.3	149.3	242.1	144.7	132.8	79.7
20	159.7	153.0	149.3	149.3	242.1	144.7	132.8	79.7
25	140.7	138.4	136.4	136.4	216.2	128.8	119.8	72.6
30	127.6	127.7	126.9	126.9	195.8	117.2	110.1	66.6
35	118.1	119.6	119.7	119.7	179.2	108.2	102.7	61.7
40	111.1	113.3	114.2	114.2	165.5	101.0	97.0	57.7
45	106.0	108.5	110.0	110.0	154.4	95.4	92.7	54.5
50	102.4	105.0	106.9	106.9	145.5	91.0	89.7	52.1
55	100.0	102.5	104.7	104.7	138.6	87.6	87.8	50.4
60	98.6	100.9	103.5	103.5	133.7	85.1	86.9	49.6
65	98.2	100.3	103.2	103.2	130.6	83.5	87.0	49.4
70	98.6	100.6	103.6	103.6	129.3	82.8	88.1	50.1
75	99.9	101.7	104.8	104.8	129.7	82.8	90.1	51.4
80	101.9	103.5	106.7	106.7	131.9	83.5	93.0	53.5
85	104.7	106.2	109.4	109.4	135.7	8.5	96.8	56.3
90	108.2	109.6	112.8	112.8	141.2	87.2	101.5	59.9
95	112.3	113.7	116.9	116.9	148.3	90.0	107.0	64.2
100	117.1	118.6	121.7	121.7	157.1	93.5	113.4	69.2
105	122.6	124.2	127.2	127.2	167.5	97.8	120.7	74.9
110	128.7	130.5	133.4	133.4	179.6	102.6	128.8	81.3

Emission volume of CO_2 can be calculated using the formula below.

$$Q_i = \sum_{i=1}^{n}(W_i \times E_i)$$

Here,

Qi: Quantity of CO_2 per 1 km (g-CO_2/km)

Ei: Emission unit of CO_2 on car type (g-CO_2/km, g-CO_2/km･t)

Wi: Weight of car (t)

The greenhouse gas emission factor on Motor Cycle is referred to "Greenhouse gas reporting: conversion factors 2019", in UK, but the emission factor is not set on each speed. Therefore, emission factor on Motor Cycle apply to 60% value on factor of small car (Light weight car) based on the ratio of emission factor of Small car and Motor Cycle.

Table 3.4-3 CO2 emission factor on Greenhouse gas reporting

Car category	CO_2 emission factor (kg CO_2/km)	Ratio by Small car
Motor Cycle（Small ; less than 125 cc）	0.08241	0.538
Motor Cycle（Medium ; 125-500 cc）	0.10004	0.653
Small car (Light weight car)	0.15301	1.000

2) Car Type and Weight

The vehicle classification in the traffic survey was consistent with the vehicle classification in the GHA pavement design manual. This study was conducted based on the classification of eight types of vehicles under the idea that the purpose is to understand traffic conditions. On the other hand, in setting the carbon dioxide emission coefficient, the vehicle weight given in the Technical Note of National Institute for Land and Infrastructure was referred and the carbon dioxide emission coefficient setting model was set as shown in Table 3.4-4.

Table 3.4-4 Car category and car type

Car category	Weight (t)	Car type	Car category on GHA
1. Motor Cycle	0.4	Gasoline lightweight car	Motor bike
2. Passenger Car	(--)	Gasoline passenger car	Car
			Taxi
			Pick-up/Van/4WD vehicle
3. Minibus	2.00	Gasoline Mediumweight car	Small bus
4. Bus	11.84	Diesel Heavyweight car	Medium bus/Mammy wagon
			Large bus
5. Light Truck	2.60	Diesel Mediumweight car	Light truck
6. Heavy Truck	11.84	Diesel Heavyweight car	Medium truck
			Heavy truck
7. Trailer			Semi-trailer (Light, Heavy)
			Truck-trailer
8. Others			Extra-large truck & others

3) Estimation of Traffic Volume for Prediction of GHG

Regarding the traffic condition to predict the GHG emission volume under this project is set in a manner that the traffic volume change includes both the changes of Phase-1 and Phase-2. The calculation conditions are shown in Table 3.4-5.

Table 3.4-5 Prediction condition for emission volume of CO_2

		Without	Without (2025/2035)	Project (2025/2035)
Intersection shape		Roundabout	Roundabout	Three-layer intersection
Peak time	Hour	3 hour	3 hour	3 hour
	Traffic volume	each Car type	each Car type	each Car type, each direction lane
	Velocity	10 km/h	5 km/h	each direction lane
Non-peak time	Hour	21 hour	21 hour	21 hour
	Traffic volume	each Car type	each Car type	each Car type, each direction lane
	Velocity	20 km/h	10 km/h	each direction lane

Note: JICA team

4) Prediction of emission volume of CO_2

Emission volume of CO_2 are calculated based on the emission factor using car type, car weight, average velocity at Tema intersection.

Table 3.4-6 Estimated traffic volume and prediction of CO_2 emission

	2015	2025	2035
Traffic volume per day	29,000	56,280	88,070
Without (Roundabout)	3,113 t-CO_2/ year	12,378 t-CO_2/ year (Compare to 2015: 403%)	19,187 t-CO_2/year (Compare to 2015:628%)
Project (3-layer intersection)	--	3,559 t-CO_2/ year (With/Without : 29%)	7,806 t-CO_2/ year (With/Without : 41%)

Traffic volume will increase 3 times from 29,000 per day in 2015 to 88,000 per day in 2035.

As the results of the prediction of CO_2, if the intersection uses continually on roundabout, the emission volume of CO_2 will increase to 6 times by considering the increment of traffic volume and traffic jam until 2035. On the other hand, CO_2 emission volume on 3-layer intersection are 3,559 t-CO_2/ year (29% /without) in 2025, 7,806 t-CO_2/ year (40%/ without) in 2035. Therefore, the Project can obtain reduction impact on CO_2 of 8,819 t-CO_2/ year in 2025 and 11,381 t-CO_2/ year in 2035.

APPENDICES

【Appendix-1】Member List of Survey Team

【Appendix-2】Survey Schedule

【Appendix-3】List of Parties Concerned in the Recipient Country

【Appendix-4】Minutes of Discussion

- 18 January, 2019
- 28 November, 2019

【Appendix-5】Technical Notes

- 1st : 19 February, 2019
- 2nd : 11 June, 2019

【Appendix-6】Outline Design Drawings

【Appendix-7】Pavement Plan from the Final Report of Phase-1

【Appendix-1】

Member List of Survey Team

Survey Team Member List

*JICA: Japan International Cooperation Agency
CTII: CTI Engineering International Co., Ltd.

Name	Position/In Charge	Organization
TANAKA Kenshiro	Team Leader	JICA
NITO Takeshi	Planning Coordinator	JICA
TSUCHIDA Takayuki	Chief Consultant/ Road and Bridge Planning 1	CTII
WATANABE Masatoshi	Deputy Chief Consultant/ Road and Bridge Planning 2	CTII
SHRESTHA Robinson	Bridge Design	CTII
OGAWA Jyunichiro	Road Design/ Road Safety Assessment	CTII
SUZUKI Yusuke	Traffic Survey/ Traffic Demand Forecast	CTII
OGATA Hiromitsu	Procurement/ Construction Planning/ Cost Estimate	CTII
BAIK Biehn	Natural Condition Survey	CTII
ONUMA Takashi	Environmental and Social Consideration	CTII
NOMURA Mitsugu	Design Review	CTII
SUZUKI Yasuyuki	BIM/CIM Advisor	CTII
OCHI Masaki	BIM/CIM Manager	CTII
FUJITA Rei	BIM/CIM Review	CTII
TOYOKAWA Yuki	Coordinator/ Assistant for Road and Bridge Design	CTII

【Appendix-2】

Survey Schedule

- **First Field Survey (13 Jan 2019-21 Feb 2019)**

No	Date	Day	Contents of Survey				
			Mr.Tanaka	Dr.Tsuchida	Mr.Watanabe	Mr.Shrestha	Mr.Ogawa
			Team Leader	Chief Consultant/Road and Bridge Planning 1	Deputy Chief Consultant/Road and Bridge Planning 2	Bridge Design	Road Design
1	13-Jan	Sun		Dep. Tokyo		Dep. Tokyo	
2	14-Jan	Mon	Dep. Tokyo	Arr. Accra		Arr. Accra	
3	15-Jan	Tue	Arr. Accra	Courtesy call to JICA		Site Survey	
4	16-Jan	Wed				Meeting with GHA	Preparation Work for 1st Site Survey
5	17-Jan	Thu	Site Visit	Site Visit with JICA			
6	18-Jan	Fri	Explanation/discussion regarding to the Survey	Explanation/discussion on the Inception Report		Explanation/discussion on the Inception Report	
7	19-Jan	Sat	Dep. Accra	Site Survey		Site Survey	
8	20-Jan	Sun		Documentation		Documentation	
9	21-Jan	Mon		Meeting with GHA			Site Survey
10	22-Jan	Tue				Meeting with GHA	Meeting with GHA
11	23-Jan	Wed					
12	24-Jan	Thu		Documentation		Engaged for Other Work (CS of Phase-1)	Work in GHA office
13	25-Jan	Fri					
14	26-Jan	Sat		Internal Meeting			Internal Meeting
15	27-Jan	Sun		Documentation			Documentation
16	28-Jan	Mon		Meeting with GHA	Dep. Tokyo		Study on Road Design
17	29-Jan	Tue			Arr. Accra		Dep. Accra
18	30-Jan	Wed		1st Technical Meeting			Via. Istanbul
19	31-Jan	Thu		Internal Meeting			Arr. Tokyo
20	1-Feb	Fri		Dep. Accra	Site Survey		
21	2-Feb	Sat		Via. Istanbul	Site Survey		
22	3-Feb	Sun		Arr. Tokyo	Documentation		
23	4-Feb	Mon			Visit to Borrow Pit and Quarry Site		
24	5-Feb	Tue			Traffic Survey at Ashaiman Roundabout		
25	6-Feb	Wed			Meeting with a person inchage of Bridge Design in GHA		
26	7-Feb	Thu			Meeting with MOF		
27	8-Feb	Fri			Meeting with EPA		
28	9-Feb	Sat			Work for Bridge Planning		
29	10-Feb	Sun			Documentation		
30	11-Feb	Mon			Work for Bridge Planning	Study on Bridge Design	
31	12-Feb	Tue					
32	13-Feb	Wed			Project Explanation to DUR		
33	14-Feb	Thu			Project Explanation to TDC		
34	15-Feb	Fri			Project Explanation to TMA		
35	16-Feb	Sat			Documentation	Preparation for Technical Note	
36	17-Feb	Sun					
37	18-Feb	Mon			2nd Technical Meeting		
38	19-Feb	Tue			Signing to T/N Dep. Accra	Report to JICA	
39	20-Feb	Wed			Via. Istanbul	Dep. Accra	
40	21-Feb	Thu			Arr. Tokyo	Arr. Tokyo	

* GHA: Ghana Highway Authority
DUR: Department Urban Road
TDC: Tema Development Corporation
TMA: Tema Metropolitan Assembly
JICA: Japan International Cooperation Agency

No	Date	Day	Contents of Survey				
			Mr.Suzuki	Mr.Ogata	Dr.Baik	Mr.Onuma	Mr.Toyokawa
			Traffic Survey / Analysis	Construction Planning/Cost Estimate	Natural Condition Survey	Social Environment Consideration	Assistant of Road and Bridge Design
1	13-Jan	Sun					Dep. Tokyo
2	14-Jan	Mon					Arr. Accra
3	15-Jan	Tue					Site Survey
4	16-Jan	Wed					Preparation for Re-commissioned Survey
5	17-Jan	Thu					
6	18-Jan	Fri					Explanation/discussion on the Inception Report
7	19-Jan	Sat					Site Survey
8	20-Jan	Sun	Dep. Tokyo		Dep. Tokyo		Documentation
9	21-Jan	Mon	Arr. Accra		Arr. Accra		Data Analysis
10	22-Jan	Tue	Site Survey		Site Survey		Meeting with GHA
11	23-Jan	Wed			Evaluation/Contract to Local Company for Soil		
12	24-Jan	Thu	Data Analysis				Data Analysis
13	25-Jan	Fri			Data Collection		Site Survey
14	26-Jan	Sat	Internal Meeting		Internal Meeting		Internal Meeting
15	27-Jan	Sun	Documentation		Documentation		Documentation
16	28-Jan	Mon	Data Analysis	Dep. Tokyo	Site Inspection for Soil Investigation		Site Inspection for Soil Investigation
17	29-Jan	Tue	Meeting with GHA	Arr. Accra	Meeting with GHA		Meeting with GHA
18	30-Jan	Wed	1st Technical Meeting				1st Technical Meeting
19	31-Jan	Thu	Internal Meeting				Internal Meeting
20	1-Feb	Fri	Dep. Accra	Site Survey	Dep. Accra		Engaged for Other Work (CS of Phase-1)
21	2-Feb	Sat	Via. Paris	Site Survey	Via. Paris		
22	3-Feb	Sun	Arr. Tokyo	Documentation	Arr. Tokyo	Dep. Tokyo	
23	4-Feb	Mon		Visit to Borrow Pit and Quarry Site		Arr. Accra	
24	5-Feb	Tue		Visit to Local Construction Company		Site Survey	
25	6-Feb	Wed		Survey and Hearing with the Contractor of Phase-1		Meeting with Environmental Section in GHA	
26	7-Feb	Thu		Meeting with MOF		Site Survey	
27	8-Feb	Fri		Meeting with GHA		Meeting with EPA	
28	9-Feb	Sat		Site Survey		Site Survey	
29	10-Feb	Sun		Documentation		Documentation	
30	11-Feb	Mon		Study on Construction Planning		Meeting with Local Consultant and GHA	
31	12-Feb	Tue					
32	13-Feb	Wed		Visit to Rebar Supplier		Documentation	
33	14-Feb	Thu		Site Survey and Data Analysis		Data Collection	
34	15-Feb	Fri				Dep. Accra	
35	16-Feb	Sat		Documentation		Via. Paris	
36	17-Feb	Sun				Arr. Tokyo	
37	18-Feb	Mon		2nd Technical Meeting			
38	19-Feb	Tue		Dep. Accra			
39	20-Feb	Wed		Via. Istanbul			
40	21-Feb	Thu		Arr. Tokyo			

*	GHA:	Ghana Highway Authority
	DUR:	Department Urban Road
	TDC:	Tema Development Corporation
	TMA:	Tema Metropolitan Assembly
	JICA:	Japan International Cooperation Agency

- **Second Field Survey and 1st Design Review by GHA (23 May 2019-14 June 2019)**

No	Date	Day	Contents of Survey						
			Dr.Tsuchida	Mr.Watanabe	Mr.Shrestha	Mr.Ogawa	Dr.Suzuki	Mr.Fujita	Mr.Ochi
			Chief Consultant/Road and Bridge Planning 1	Deputy Chief Consultant/Road and Bridge Planning 2	Bridge Design	Road Design	BIM/CIM Adviser	BIM/CIM Expert	BIM/CIM Manager
1	23-May	Thu	Dep. Tokyo			Dep. Tokyo			
2	24-May	Fri	Arr. Accra			Arr. Accra		Dep. Tokyo	
3	25-May	Sat	Site Survey			Site Survey		Arr. Accra	
4	26-May	Sun	Internal Meeting	Dep. Tokyo		Internal Meeting			
5	27-May	Mon	Documentation	Arr. Accra		Documentation			
6	28-May	Tue	Meeting with GHA			Site Survey and Discussion with the Contractor of Phase-1			
7	29-May	Wed	Technical Meeting			Technical Meeting			
8	30-May	Thu	Meeting with GHA		Dep. Tokyo	Meeting with GHA			Preparation of SM
9	31-May	Fri	Stakeholder Meeting		Arr. Accra	Stakeholder Meeting			
10	1-Jun	Sat	Documentation, Internal Meeting				Dep. Accra	Dep. Accra	Documentation, Internal Meeting
11	2-Jun	Sun					Via. Istanbul	Via. Istanbul	
12	3-Jun	Mon	Discussion with GHA				Arr. Tokyo	Arr. Tokyo	
13	4-Jun	Tue	Report to JICA, Dep. Accra	Report to JICA		Internal Meeting			
14	5-Jun	Wed	Via. Paris	Dep. Accra	Making Minutes	Site Survey			Photogrammetry by UAV
15	6-Jun	Thu	Arr. Tokyo	Via. Paris	Discussion with GHA	Dep. Accra			
16	7-Jun	Fri		Arr. Tokyo		Via. Paris			
17	8-Jun	Sat			Documetation	Arr. Tokyo			
18	9-Jun	Sun							
19	10-Jun	Mon			Discussion with GHA				
20	11-Jun	Tue			Report to JICA				Dep. Accra
21	12-Jun	Wed			Dep. Accra				Via. Istanubul
22	13-Jun	Thu			Via. Paris				Arr. Tokyo
22	14-Jun	Fri			Arr. Tokyo				
*	GHA:	Ghana Highway Authority							
	JICA:	Japan International Cooperation Agency							

● Third Field Survey (23 Nov 2019-1 Dec 2019)

No	Date	Day	Contents of Survey					
			Mr.Tanaka	Mr.Nito	Dr.Tsuchida	Mr.Watanabe	Mr.Shrestha	Dr.Suzuki
			Team Leader	Planning Coordinator	Chief Consultant/Road and Bridge Planning 1	Deputy Chief Consultant/Road and Bridge Planning 2	Bridge Design	BIM/CIM Adviser
1	23-Nov	Sat			Dep. Tokyo		Dep. Tokyo	Arr.Accra
2	24-Nov	Sun	Dep. Tokyo (Next morning Arr. Accra)		Arr. Accra	Dep. Tokyo	Arr. Accra	Documentation
3	25-Nov	Mon	Meeting with JICA Ghana					
4	26-Nov	Tue	AM: Courtesy call to MRH, MOF and GHA, PM: Site Visit					
5	27-Nov	Wed	Meeting with GHA					
6	28-Nov	Thu	Signature on Minutes of Discussions					
7	29-Nov	Fri	AM: Meeting with EOJ, PM: Dep. Accra		Meeting with EOJ		Documentation	Dep. Accra
8	30-Nov	Sat	Arr. Tokyo		Dep. Accra			
9	1-Dec	Sun			Arr. Tokyo			

*	GHA:	Ghana Highway Authority
	MRH:	Ministry of Roads and Highways
	MOF:	Ministry of Finance
	JICA:	Japan International Cooperation Agency
	EOJ:	Embassy of Japan in Ghana

【Appendix-3】

List of Parties Concerned in the Recipient Country

JICA Ghana Representative Office	
Maki OZAWA	Senior Representative
Masashi YAMAMOTO	Representative
Ayumi GOSHO	Project Formulation Advisor (Infrastructure)
Syoko NAKANO	Project Formulation Advisor (Infrastructure)
MABE Biliwi Joshua	Programme Officer

Ministry of Roads and highways	
Mr. Edmund Offei-Annor	Chief Director
Ing. Ohene Sarfoah	Director of Policy and Planning

Ministry of Finance	
Mr. Emmanuel Edumadze Mensah	Principal Budget Analyst
Ms. Vivian Darah	N/A

Ghana Highway Authority	
Ing. Ernest Kingsley Arthur	Chief Executive
Ing. Amin Baba Kassim Nuhu	Deputy Chief Executive (Dev't)
Surveyor Joseph Tengey	Manager of Quantity Surveying
Ing. Pual Duah	Highway Design Manager
Ing. Collins Donkor	Director of Contracts
Ing. Yaqub Koray	Ag. Director of Bridges
Ing. Victor Nyantakyi-Baah	Bridge Design Manager
Ing. Mercy Payne	Strategic Monitoring and Implementation Manager
Ms. Hilda Annan	Senior Environmental Officer
Ms Janice Omari Frimpong	Road Safety Unit Manager

Department of Urban Roads, Tema	
Mr. Stephen Attipoe	Metropolitan Roads Engineer

Tema Development Corporation	
Mr. Emmanuel Kwasi Darkey	Head of Development
Mr. Sam O. Asante	General Manager, Operations

Ghana Metropolitan Authority	
Mr. Hon. Felix Mensah Nii Anang-La	Mayor of Tema

SHIMIZU-DAI NIPPON JV (Contractor of Phase-1)	
Mr. UEMURA Yujin	Project Manager
Mr. NARITA Susumu	Deputy Project Manager
Mr. OKABE Masayoshi	Construction Manager

【Appendix-4】

Minutes of Discussion

18 January, 2019

Minutes of Discussions
on the Preparatory Survey for the Project for
Improvement of the Tema Motorway Roundabout (Phase 2)
in the Republic of Ghana (Outline Design Study)

In response to a request from the Government of the Republic of Ghana (hereinafter referred to as "Ghana"), Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") of the Project for Improvement of the Tema Motorway Roundabout (Phase 2) (hereinafter referred to as "the Project") to Ghana. The Team held series of discussions with the officials of the Government of Ghana (hereinafter referred to as "GoG") and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Accra, January 18, 2019

Kenshiro TANAKA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Edmund Offei-Annor
Chief Director
Ministry of Roads and Highways
Republic of Ghana

Emmanuel K. Fordjour
Ag. Director
Resource Mobilization and
Economic Relations Division
Ministry of Finance
Republic of Ghana

Ernest Kingsley Arthur
Chief Executive
Ghana Highway Authority
Republic of Ghana

ATTACHMENT

1. Objective of the Project

   The objective of the Project is to improve the Tema Motorway Roundabout by constructing a flyover, thereby contributing to improved urban mobility and logistics in the Greater Accra Region as well as regional corridors.

2. Title of the Preparatory Survey

   Both sides confirmed the title as the Preparatory Survey for the Project for Improvement of the Tema Motorway Roundabout (Phase 2) (hereinafter referred to as "the Survey").

   In order to differentiate, the on-going project for the improvement of the Tema Motorway Roundabout is referred to as the "Phase 1 Project".

3. Project site

   Both sides confirmed that the site of the Project is in Greater Accra Region, which is shown in Annex 1.

4. Responsible and Executing organisations for the Project

   Both sides confirmed the organisations, of which organisation charts are shown in Annex 2, responsible for the Project are as follows:

   4-1. The responsible organisation of the Project is the Ministry of Roads and Highways (hereinafter referred to as the "MRH") which shall be responsible for supervising the Executing Agency on behalf of GoG.

   4-2. The Ghana Highway Authority (hereinafter referred to as the "GHA") will be the executing agency for the Project. GHA shall coordinate with all the relevant organisations to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant organisations properly and on time.

5. Items requested by the Government of Ghana

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

   - Construction of a flyover bridge over the Tema Motorway Roundabout after completion of the Phase 1 Project, which is under construction at the same

project site.

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 approved by the Government of Japan.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Ghanaian side agreed that the procedures and basic principles of Japanese Grant as described in Annex 3, 4 and 5 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires the Ghanaian side to submit the Project Monitoring Report, the form of which is attached as Annex 6.

6-2. The Ghanaian side agreed to take the necessary measures, as described in Annex 7, for the smooth implementation of the Project. The contents of the Annex 7 will be elaborated and refined during the Survey and be agreed during the next mission dispatched to Ghana for explanation of the Draft Survey Report.

The contents of Annex 7 will be updated as the 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 Ghana until 21st February, 2019.

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

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

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

8. Environmental and Social Considerations

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

8-2. The Project is categorized as "B" from the following considerations:

The Ghanaian side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Environmental Impact Assessment (EIA) / Initial Environmental Examination (IEE) and

information disclosure, etc.) and make EIA/IEE report of the Project. The EIA/IEE approval shall be received from the responsible authorities and submitted to JICA Ghana Office within 1 month after signing of Grant Agreement. The Ghanaian side shall bear the expenses of the procedures.

8-3. Both sides confirmed that Environmental Permit is necessary for the Project in accordance with the Environmental Assessment Regulations of GoG, and that GHA shall obtain the permit for the Project through the following procedures:

1) GHA shall submit an application to the Environmental Protection Agency (EPA) for screening in line with the Environmental Impact Assessment (EIA) procedure. GHA shall provide to the JICA Ghana Office the result of the screening conducted by EPA.
2) The GHA shall prepare a scoping and a draft EIA report in accordance with the response by EPA.
3) GHA shall submit the draft EIA report to EPA, complete necessary procedures for EIA and obtain the Environmental Permit before the commencement of the Project. GHA shall provide the result of EIA to the JICA Ghana Office.
4) Where renewal of the existing environmental permit is permissible, application procedures as mentioned in 1), 2) and 3) are to be restricted to such renewal in line with EPA guidelines. GHA shall submit necessary renewal documents required by JICA (such as updated EIA report, environmental report and permit) to JICA Ghana Office before commencement of the Project.

9. Other Relevant Issues

9-1. The Team explained a method of the Survey based on an inception report submitted by the Team. The Ghanaian side understood the contents and accepted the method.

9-2. Both sides confirmed that no land acquisition and no relocation of residents shall be undertaken in the Project. All of the roads and structures to be constructed in the Project shall be in the land of the Phase 1 Project. GoG shall be responsible to secure the land for the Project.

9-3. In case design changes of the Phase 1 Project are necessary based on the result of the Survey, the Team shall consult with the Ghanaian side and JICA without delay.

9-4. During the Survey, the Team shall analyse possible effects on traffic at Ashaiman

Intersection, next to Tema Roundabout on northbound, after completion of the Project and propose concepts of countermeasures against possible traffic congestion. The countermeasures shall not be included in the Project.

9-5. The Team will conduct some parts of its survey in the site of the Phase 1 Project, which are under construction. The Team shall consult safety measures with the Ghanaian side and the contractor of the Phase 1 Project before their site survey and the Ghanaian side shall take necessary safety measures for it.

9-6. GHA shall conduct a Design Review under MRH Guidelines for Design Review 2016. The detail of the Design Review is shown as followings;

Objective: To ensure that the design conforms to GHA's design codes and standards, and international best practices.

Responsible Division: Planning Division

Contents:
1) Functional and structural adequacy
2) Geometry and clearances
3) Drainage
4) Road Safety considerations
5) Environmental and Social considerations
6) Aesthetics
7) Selection of construction materials
8) Evaluation of life cycle cost
9) Pavement considerations

Timing and Deadline: 2 weeks after submission of designs

JICA understood the necessity of the Design Review in principle and shall dispatch some members of the Team for the Design Review. JICA requested the Design Review should be concluded by the deadline to keep the schedule of the Survey and the Project and the Ghanaian side understood it.

9-7. The Ghanaian side shall, at its own expense, provide the Team with following items in cooperation with other organisations concerned;

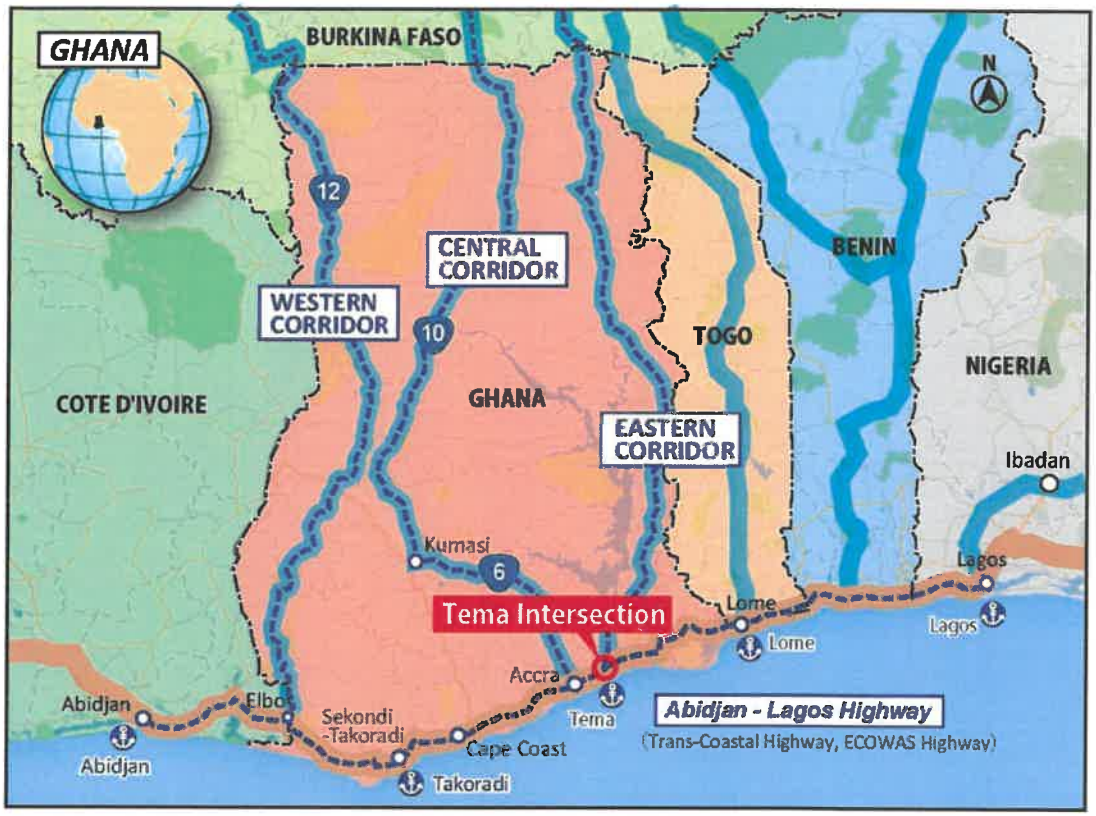
- Security-related information as well as measures to ensure safety of the survey team;
- Counterpart personnel,
- Identification cards if necessary,
- Permissions of conducting field activities, such as a topographic survey, geotechnical investigations, environmental and social considerations, a traffic volume survey, etc. and,
- Support in obtaining other privileges and benefits, if necessary.

9-8. The Ghanaian side agreed to provide the Team with the following information for effective and efficient implementation of the Survey;

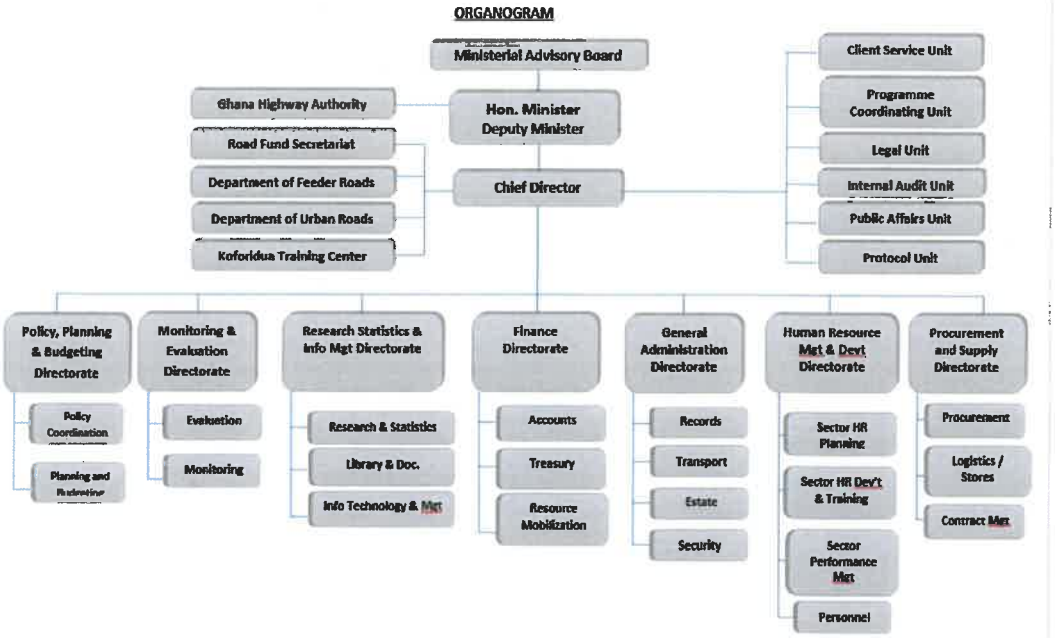
Natural Condition Data:	geology, topography, hydrology, drainage (road and urban), meteorology, etc.
Traffic Condition Data:	vehicle registration, logistic statistics, traffic statistics of general roads, toll roads and in/out of ports, traffic facility, traffic regulations and standards, development plans, traffic accident statistics, traffic safety regulations, etc.)
Social Condition Data:	demography, commerce and industry, public facilities (schools, hospitals, etc.), gender consideration, etc.
Construction Situation:	regulations and standards, construction companies, material procurement, quality control, construction safety, utilizing information and communication technologies, etc.)

Annex 1 Project Site
Annex 2 Organisation Charts
Annex 3 Japanese Grant
Annex 4 Procedures of Japanese Grant
Annex 5 Financial Flow of Grant
Annex 6 Project Monitoring Report (template)
Annex 7 Major Undertakings to be taken by the Government of Ghana

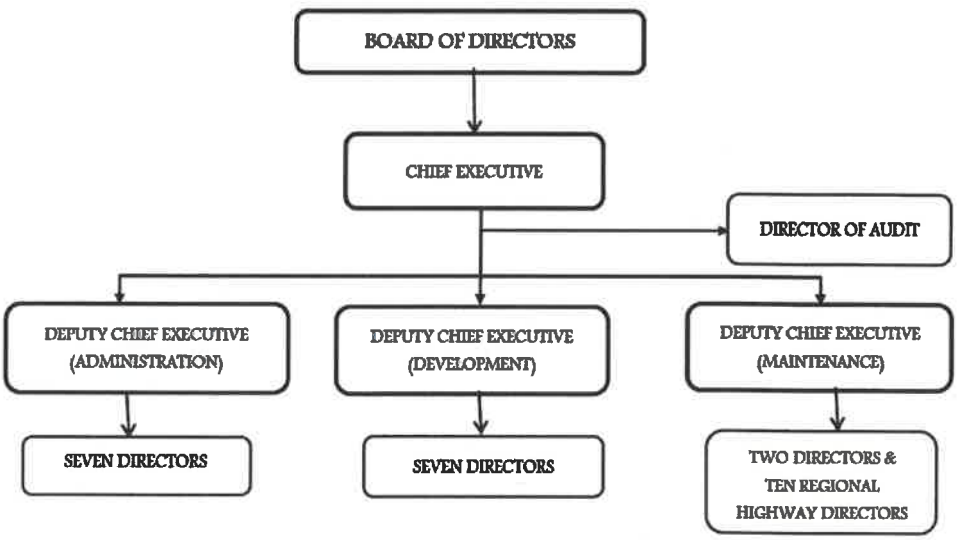
Annex 1 Project Site



Annex 2 Organisation Charts



Organisation Chart of Ministry of Roads and Highways



Organisation Chart of Ghana Highway Authority

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 singed 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) Proper Use

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

4) Export and Re-export

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

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			

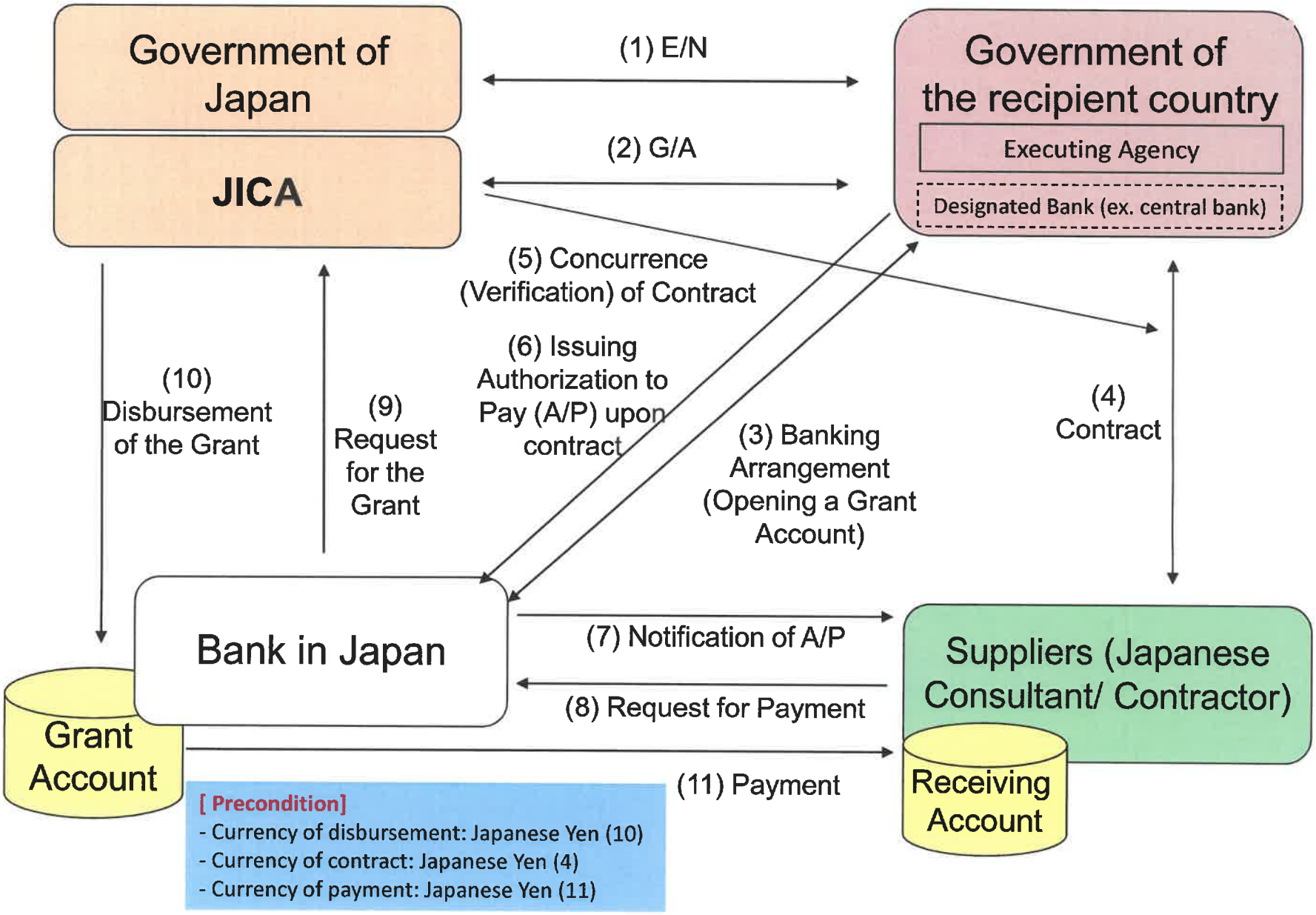
notes:

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.

Annex 5

Financial Flow of Japanese Grant (A/P Type)



AP4-17

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

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

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:
	Contingency Plan (if applicable):
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:
	Contingency Plan (if applicable):
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)

Attachment 6

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%)	

Annex 7

Major Undertakings to be taken by the Government of Ghana

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

(1) Before the Bidding

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open bank account (B/A)	within 1 month after signing of G/A			
2	To issue Authorization to Pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract			
3	To approve IEE/EIA (Conditions of approval should be fulfilled, if any) and secure necessary budget for implementation	within 1 month after the signing of G/A			
4	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	till land acquisition and resettlement complete			
5	To secure and clear the following land 1) the Project sites 2) temporary constructions yard and stock yards near the Project sites 3) borrow pits and disposal sites near the Project sites	before notice of the bidding document			
6	To clear, level and reclaim the sites, which will be confirmed in the draft final report.	before notice of the bidding document			
7	To obtain the planning, zoning, building permit	before notice of the bidding document			
8	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding document			

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after signing of the contract			
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract			
	2) Payment commission of A/P	every payment			
3	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country and to assist the Supplier with internal transportation therein.				
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			
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 exempted;	during the Project			
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.	during the Project			
7	1) To submit Project Monitoring Report	every month			
	2) To submit Project Monitoring Report (final)	within 1 month after signing of Certificate of Completion for the works under the contract			
8	To submit a report concerning completion of the Project	within 6 months after completion of the Project			
9	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)				
	1) Electricity The distributing line to the site	before start of the construction			
	2) Water Supply The city water distribution main to the site	6 months before completion of the construction			
	3) Drainage The city drainage main (for storm, sewer and others) to the site	6 months before completion of the construction			
10	To take necessary measure for safety construction - traffic control	during the construction			
11	To implement EMP and EMoP	during the construction			
12	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction			

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP			
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between MTP and JICA.	for 3 years after the Project			
3	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			

2. Major Undertakings to be covered by the Grant Aid

NO	Items	Deadline	Amount (Million Japanese Yen)
1	Construction of a bridge and approach roads		
2	To implement detailed design, bidding support and construction supervision (Consulting Service)		
3	Contingencies		
	Total		XXX

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

28 November, 2019

Minutes of Discussions
on the Preparatory Survey for the Project for
Improvement of the Tema Motorway Roundabout (Phase 2)
in the Republic of Ghana
(Explanation on Draft Preparatory Survey Report)

With reference to the minutes of discussions signed among Ministry of Roads and Highways (hereinafter referred to as "MRH"), Ghana Highway Authority (hereinafter referred to as GHA"), Ministry of Finance (hereinafter referred to as "MOF") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 18th January, 2019, and in response to the request from the Government of Republic of Ghana (hereinafter referred to as "GOG"), 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 Improvement of the Tema Motorway Roundabout (Phase 2) (hereinafter referred to as "the Project").

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

Accra, 28th November, 2019

Kenshiro TANAKA
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Edmund OFFEI-ANNOR
Chief Director
Ministry of Roads and Highways
Republic of Ghana

Yvonne QUANSAH
Director
Resource Mobilisation and Economic
Relations Division
Ministry of Finance
Republic of Ghana

Nicholas Dome BROWN
Acting Chief Executive
Ghana Highway Authority
Republic of Ghana

ATTACHMENT

1. Objective of the Project

   The objective of the Project is to improve the Tema Motorway Roundabout by constructing a flyover, thereby contributing to improved urban mobility and logistics in the Greater Accra Region as well as regional corridors.

2. Title of the Preparatory Survey

   Both sides confirmed the title as the Preparatory Survey for the Project for Improvement of the Tema Motorway Roundabout (Phase2) (hereinafter referred to as "the Survey").

   In order to differentiate, the on-going project for the improvement of the Tema Motorway Roundabout is referred to as the "Phase 1 Project".

3. Responsible Authority for the Project

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

   3-1. The responsible organization of the Project is MRH, which shall be responsible for supervising the Executing Agency on behalf of GOG.

   3-2. GHA will be the Executing Agency for the Project. GHA shall coordinate with all the relevant organizations to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant organizations properly and on time.

4. Contents of the Draft Report

   After the explanation of the contents of the Draft Report by the Team, the GOG side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the GOG side around March 2020.

5. Cost Estimate

   Both sides confirmed that the cost estimate including the contingency explained by the Team is provisional and will be examined further by the Government of Japan (hereinafter referred to as "GOJ") for its approval. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.

6. Confidentiality of the Cost Estimate and Technical Specifications
Both sides confirmed that the cost estimate, as attached in Annex 1, and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

7. Timeline for the Project Implementation
The Team explained to the GOG side that the expected timeline for the Project implementation is as attached in Annex 2.

8. Expected Outcomes and Indicators
Both sides agreed that key indicators for expected outcomes are as follows. The GOG side will be responsible for the achievement of agreed key indicators targeted in year 2026 and shall monitor the progress for Ex-Post Evaluation based on those indicators.
[Quantitative Indicators]

Index	Basic Value (Actual Record of 2015)	Target Value in 2026 (3 years after the Project Completion)
Passenger Volume	86.6 mil. passengers/year	185.7 mil. passengers/year
Freight (Cargo) Volume	44.3 mil. tons/year	91.5 mil. tons/year
Travel Time per minute (AM peak hour at Accra-Aflao 2.0km) (AM peak hour at Akosombo-Harbour 2.0km)	8.2 minutes 15.6 minutes	2.0 minutes 2.0 minutes

[Qualitative Indicators]
- Moderate traffic congestion and to provide uninterrupted traffic flow.
- Facilitate and grade up transit system in the West African Region.
- Stabilize carrier-transit time and effectiveness in logistics leaving and arriving at the Tema Port will be improved.
- Improve traffic safety of pedestrians and vehicles at the intersection.
- Reduce future emission of transport related greenhouse effect.
- Connect links between Coastal Highways (Coastal Corridor) and East Highways (East Corridor) will be enhanced.

9. Ex-Post Evaluation
JICA will conduct ex-post evaluation after three (3) years from the Project completion, in principle, with respect to five evaluation criteria (Relevance,

Effectiveness, Efficiency, Impact and Sustainability). The result of the evaluation will be publicized. The GOG side is required to provide necessary support for the data collection.

10. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 3. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in 1. (2) 5 of Annex 3, both sides confirmed that such customs duties, internal taxes and other fiscal levies, which shall be clarified in the bid documents by GHA during the implementation stage of the Project.

The GOG 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 3 will be reviewed and attached to the G/A. The revision of Annex 3 will be concluded among JICA, Embassy of Japan, MOF and Ministry of Foregn Affairs and Regional Integration before G/A signing.

Both sides confirmed that GHA 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, as shown in Annex 3.

Both sides agreed that in case the additional security cost would be necessary for the implementation of the Project, such cost shall be borne by the Recipient without using the Grant.

11. Monitoring during the Implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (PMR) attached as Annex 4. The timing of submission of the PMR is described in Annex 3.

12. Project Completion

Both sides confirmed that the Project will be deemed completed 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, but in any event not later than six months after completion of the Project.

13. 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.

- Tax exemption described in 1. (2) 5 of Annex 3 is approved by the Parliament.
- Construction safety secured with reference to the "Guidance of the Management of Safety for Construction Works in Japanese ODA Projects".

14. Environmental and Social Considerations

14-1 General Issues

14-1-1 Environmental Guidelines and Environmental Category

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as B because the Project is not considered as a large-scale road and bridge project, is not located in a sensitive area, and has none of the sensitive characteristics under the Guidelines, it is not likely to have significant adverse impact on environment.

14-1-2 Environmental Checklist

Measures for the Project are summarized in the Environmental Checklist attached as Annex 5. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, the GOG side shall submit the modified version to JICA in a timely manner.

14-2 Environmental Issues

14-2-1 Environmental Permit

Both sides confirmed the Environmental Permit report will be renewed by Environmental Protection Agency (EPA) in June 2020.

14-2-2 Environmental Monitoring Plan

Both sides confirmed Environmental Monitoring Plan (EMoP) of the Project is indicated in Annex 6. Both sides agreed that environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated during the detailed design stage.

14-3 Environmental and Social Monitoring

14-3-1 Environmental Monitoring

Both sides agreed that the GOG side will submit results of environmental monitoring to JICA by using the monitoring form attached as Annex 7. The timing of submission of the monitoring form is described in Annex 3.

14-3-2 Information Disclosure of Monitoring Results

Both sides confirmed that the GOG side will disclose results of environmental and social monitoring to local stakeholders through their website / in their field offices. The GOG side agreed JICA will disclose results of environmental and social monitoring submitted by the GOG side as the monitoring forms attached as Annex 7 on its website.

15. Other Relevant Issues

15-1 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.

15-2 Effects of the Widening of Tema Motorway on the Project

Both sides comfirmed that the Project and the Widening of Tema Motorway will not interfere with each other. Both sides will exchange the information of the projects to avoid any conflicts of their works.

15-3 Maintenance of Tema Motorway Interchange

Both sides confirmed that GOG will maintain Tema Motorway Interchange after the completion of the construction works. The maintenance cost shall be borne by GOG.

15-4 Construction Period of the Project

The GOG side requested to shorten the construction period, which is shown in the Preparatory Survey Report, 29 months. JICA assured GOG that the possibility of shortening the construction period shall be considered in the detailed design stage.

15-5 3-Dimensional Modeling

In response to the Teams' explanation on the composite frame structure that applies steel pier connected by means of an anchor frame to a concrete foundation, GHA

requested the Team to consider furnishing 3-dimensional models showing the details of the structure for better understanding of the design as well as during the construction, as this type of structure is first of its kind in Ghana.

Annex 1 Project Cost Estimation
Annex 2 Project Implementation Schedule
Annex 3 Major Undertakings to be taken by the Government of the Republic of Ghana
Annex 4 Project Monitoring Report (template)
Annex 5 Environmental Check List
Annex 6 Environmental Monitoring Plan
Annex 7 Environmental and Social Monitoring Form
Annex 8 Tax Exemption Letter from MOF (Ref:No. RMERD/TPU/JICA/019)

Annex 1 Project Cost Estimation

CONFIDENTIAL

(1) Cost Borne by GOJ

Total: [redacted]

- Civil Work: [redacted]
- Detailed Design and Construction Supervisory Service: [redacted]
- Contingency: [redacted]

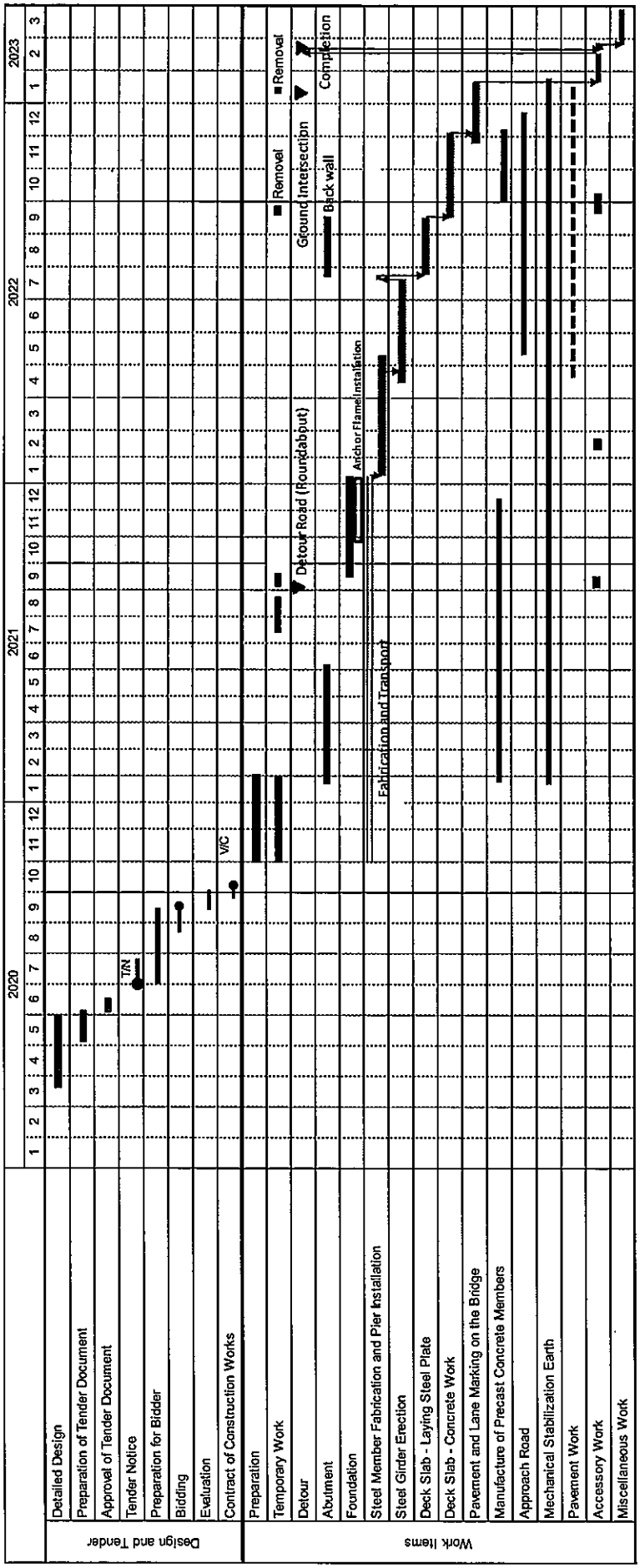
(2) Cost Borne by GOG

- Bank Charges: GH¢300,000

(3) Conditions of Cost Estimation

- Estimated timing: February 2019
- Exchange rates: USD 1.00 = JPY 112.67
  GH¢ 1.00 = JPY 23.04
- Others: The project is implemented in accordance with the system of Japan's Grant Aid. The above cost estimation does not assure the ceiling cost on the E/N and shall be reviewed by GOJ before signing of the E/N between the two Governments.

Annex 2 Project Implementation Schedule



Annex 3

Major Undertakings to be taken by the Government of Ghana

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

(1) Before the Bidding

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open bank account (B/A)	within 1 month after signing of G/A	GHA MOF		
2	To issue Authorization to Pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	GHA MOF	2,400 GH¢	
3	To renew the Environmental Permit issued by EPA and secure necessary budget for implementation	within 1 month after the signing of G/A	GHA	Not disclosed	
4	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	till land acquisition and resettlement complete	GHA		
5	To secure and clear the following land 1) the Project sites 2) temporary constructions yard and stock yards near the Project sites 3) facilitate for the contractor to secure borrow pits and disposal sites near the Project sites	before notice of the bidding document	GHA		
6	To obtain the planning, zoning, building permit	Not applicable			
7	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding document	GHA		

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after signing of the contract	GHA		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract	GHA	118,200 GH¢	
	2) Payment commission of A/P	every payment	GHA	179,400 GH¢	
3	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country and to assist the Supplier with internal transportation therein.	during the Project	GHA		
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	GHA		
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 exempted;	during the Project	To Be Decided		RME RD/TPU/JICA/019 (Annex 8)
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.	during the Project	GHA		
7	1) To submit Project Monitoring Report	every month	GHA		
	2) To submit Project Monitoring Report (final)	within 1 month after signing of Certificate of Completion for the works under the contract	GHA		
8	To submit a report concerning completion of the Project	within 6 months after completion of the Project	GHA		
9	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)				
	1) Electricity The distributing line to the site	before start of the construction	GHA		
	2) Water Supply The city water distribution main to the site	6 months before completion of the construction	GHA		
	3) Drainage The city drainage main (for storm, sewer and others) to the site	6 months before completion of the construction	GHA		

NO	Items	Deadline	In charge	Estimated Cost	Ref.
10	To take necessary measure for safety construction - traffic control	during the construction	GHA		
11	To implement EMP and EMoP	during the construction	GHA		
12	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	GHA		
13	To renew the Environmental Permit issued by EPA and secure necessary budget for implementation	during the construction	GHA	Not disclosed	
14	To secure and clear the following land 1) the Project sites 2) temporary constructions yard and stock yards near the Project sites 3) facilitate for the contractor to secure borrow pits and disposal sites near the Project sites	during the construction	GHA		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	GHA		
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between GHA and JICA.	for 3 years after the Project	GHA		
3	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	GHA		

2. Major Undertakings to be covered by the Grant Aid

NO	Items	Deadline	Amount (Million Japanese Yen)
1	Construction of a bridge and approach roads		
2	To implement detailed design, bidding support and construction supervision (Consulting Service)		
3	Contingencies		
	Total		XXX

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

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

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

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 spare parts, 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:
	Contingency Plan (if applicable):
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:
	Contingency Plan (if applicable):
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)

○onitoring sheet on price of specified materi○

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%)	

Annex 5 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N (d) N	(a) The EIA report is preparing and will be submitted to Environmental Protection Agency in March 2017. (b)(c) If the amendment of the EIA report is not required, the report will be approved within 50 days after the submission. (d) The other permissions related to environmental management are not required.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) A stakeholder meeting was conducted in May 2019 and the understanding has been obtained from local stakeholders. (b) The results of interview surveys to the local people and stakeholder meetings with the other relevant organizations were reflected in the design policy and mitigation measures for environmental impacts during construction phase.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Several alternative plans on the structure of the intersection have been examined with social and environmental considerations at the preparatory study.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(a) - (b) -	(a)(b) Because the project site is located in industrial area, considerable air pollution is feared. However, continuous monitoring of the air quality is not conducted. It is unknown whether the air quality exceeds the environmental standards or not. In the future, total amount of air pollutant caused by vehicle exhaust gas will increase. However, because of improved traffic efficiency, the amount may be reduced compared to without project.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) N (b) N (c) N	(a) Turbid water will generate in the construction works. The turbid water will be disposed into existing drainage ditches along the roadside and not drain into the surrounding area. There are no intake facilities in and down the site. (b) Because drainage facilities have been constructed along the road, impact on water resources of runoff from road surface will not occur. (c) Development of parking or service areas, which generate wastewater in operation phase, are not included in the project.
	(3) Wastes	(a) Are wastes generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?	(a) N	(a) Development of parking or service areas are not included in the project.
	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) N	(a) The noise level on the borderline of the right of way exceed the environmental standards at present. However, because the project site is located in commercial or industrial area, the impact on general population will not be serious. In the future, noise level caused by vehicle driving will increase. However, because flyover bridges will be installed in central part of the right of way as main driving lanes, the level on roadside may be reduced compared to without project. To prevent increase in noise and vibration level, GHA should maintain favorable road surface condition.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) There are no protected areas in the site and project affected areas.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) N (b) N (c) N (d) N (e) N (f) N	(a) There are no ecological valuable habitats in and around the site. (b) The habitats of endangered species have not been identified in and down the site. (c) Significant ecological impact will not occur. (d) Wild animals migrating through the site have not been identified. (e)(f) The project will not cause destruction of forest and poaching because of construction works along existing road in urban area.
	(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) Alteration of topographic features and tunnel construction are not included in the project.
	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered	(a) N (b) N (c) N	(a)(b) Small-scale cutting and filling works are included in the construction. However, there are no steep slope areas to occur slope failures or landslides in and around the site. (c) Adequate cutting and filling prevent accidental and sufficient soil runoff.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?		
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?(d) Are the compensations going to be paid prior to the resettlement?(e) Are the compensation policies prepared in document?(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?(g) Are agreements with the affected people obtained prior to resettlement?(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?(i) Are any plans developed to monitor the impacts of resettlement?(j) Is the grievance redress mechanism established?	(a) N (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	There is no involuntary resettlement because all the project site of Phase-2 is inside of the area of Phase-1.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Living and Livelihood	(a) Where roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that roads will impede the movement of inhabitants? (f) Is there any possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?	(a) N (b) N (c) N (d) Y (e) Y (f) N	(a) Because of improvement project of existing arterial road in developed area, the project will not cause significant adverse changes and impacts on the livelihood of the local people and road traffic in operation phase. (b) Residents have already done resettlement before the start of Phase-1. (c) Because of improvement project of existing arterial road in developed area, mass immigration from other areas is unlikely to occur. (d) Traffic congestion and control, and relocation of bus stops will be inevitable in construction phase. The proper construction planning and traffic management will mitigate the impact. (e) Due to the improvement of the intersection structure, the project is likely to impede the movement of local inhabitants. Installation of pedestrian bridges will be included in the project. (f) Because the distance between newly constructed bridges and roadside is too long and there are no residents around the project site, impact on sun shading and radio interference will not occur.
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There is no heritage in the site and project affected areas.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape?	(a) N	(a) There are no valuable landscape sites in and around the project sites.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		Are necessary measures taken?		
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?	(a) N (b) N	(a)(b) The project site is not area where ethnic minorities and indigenous people having unique culture and lifestyle are living.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country, which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment, which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures being taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) Construction works will comply with the laws and ordinances associated with the working conditions. (b) Because construction works on higher ground are included, tangible safety considerations to prevent labor accidents will be involved in the project. (c)(d) Because the construction works are conducted along existing arterial road in urban area, health program and safety training to construction workers and considerations to local residents will be included in the environmental management plan.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) Y (c) Y	(a) The adequate mitigation measures including coordination of construction time and methods and monitoring plans to reduce impacts of pollution during the construction will be prepared. (b) The construction activities will not adversely affect the natural environment. (c) Because the construction works are conducted along existing arterial road in urban area, countermeasures against traffic jam will be included in the execution scheme.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The monitoring plans mentioned in the EIA report will be implemented during the construction and operation phase. (b)(c)(d) Because the EIA report is in progress, the specific monitoring plans have not been prepared yet. JICA survey team has submitted the draft monitoring plan to GHA.
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).(b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a) N(b) N	(a) Deforestation is not included in the project.(b) Relocation of existing power transmission lines will be limited in the right of way and has no serious environmental impacts.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) Impacts to transboundary or global environmental issues will not occur.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Annex 6 Environmental Monitoring Plan

Category	Environmental Item	Monitoring Item/ Parameter	Responsible Person and Organization	Location	Method	Frequency
Pollution	Air pollution	**Construction Phase:** · Dust · PM10, PM2.5, NOx, SOx	Supervising Consultant Contractor	Construction site	Visual observation and interview to pedestrians Instrumental analysis	Visual observation: Daily Interview: Monthly or as needed Instrumental analysis: Pre-Construction Phase 1 time Construction Phase 5 times Total 6 times
		Operation Phase: · PM10, PM2.5, NOx, SOx	GHA	Around Tema intersection.	Instrumental analysis	1 time in dry season and 1 time in rainy season per year for 2 years after completion Total 4 times
	Water pollution	**Construction Phase:** · Turbid water and drainage conditions	Supervising Consultant Contractor	Construction site	Visual observation	During rainfall
	Waste	**Construction Phase::** · Disposal methods of construction and general waste	Supervising Consultant Contractor	Construction site and disposal site	Visual observation and meeting with contractor	Visual observation: Daily Meeting: Monthly or as needed
	Noise and vibration	**Construction Phase:** · Noise level · Vibration level	Supervising Consultant Contractor	Construction site	Interview to local residents and pedestrians Instrumental measurement	Interview: Monthly or as needed Instrumental measurement: Pre-Construction Phase 1 time Construction Phase 5 times Total 6 times
		Operation Phase: · Noise level · Vibration level	GHA	In and around Tema intersection	Instrumental measurement	1 time per year for 2 years after completion Total 2 times
Social Environment	Resettlement/ Land Acquisition	**Pre-Construction Phase:** · Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed
	Poor people	**Construction Phase:** · Activity conditions of street venders	Supervising Consultant Contractor	Construction site	Visual observation	Daily

Category	Environmental Item	Monitoring Item/ Parameter	Responsible Person and Organization	Location	Method	Frequency
	Local economies, such as employment, livelihood, etc.	**Pre-Construction Phase:** · Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed
		Construction Phase: · Business activity around construction site · Employment situation of unskilled labor	Supervising Consultant Contractor	Construction site	Site survey and interview to local people and unskilled labors	Monthly or as needed
	Land use and utilization of local resources	**Pre-Construction Phase:** · Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAP	Monthly or as needed
		Operation Phase: · Condition of land use · Condition of business activity	GHA TDC	In and around Tema intersection	Site survey and interview to local people	Monthly or as needed for 2 years after completion
	Existing social infrastructures and services	**Pre-Construction Phase:** · Relocation status of existing infrastructure facilities	GHA	In and around Tema intersection	Site survey and meeting with facility owners	Monthly or as needed
		Construction Phase: · Condition of traffic congestion around construction site	Supervising Consultant Contractor	Construction site	Visual observation	Daily
		Operation Phase: · Crossing conditions of pedestrians	GHA	In and around Tema intersection	Site survey and interview to local people	Monthly or as needed for 2 years after completion
	Misdistribution of benefits and damages	**Pre-Construction Phase:** · Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed

Category	Environmental Item	Monitoring Item/ Parameter	Responsible Person and Organization	Location	Method	Frequency
		Operation Phase: · Living situations of Project Affected Persons (PAPs)	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed for 2 years after relocation
	Local conflicts of interest	**Pre-Construction Phase:** · Progress of resettlement action plan	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed
		Operation Phase: · Living situations of Project Affected Persons (PAPs)	GHA	Around Tema intersection and relocation sites	Site survey and meeting with PAPs	Monthly or as needed for 2 years after relocation
	Landscape	**Construction Phase:** · Status of tree felling · Status of Planting works	Supervising Consultant Contractor	Construction site	Visual observation and meeting with contractor	Daily
	Working conditions (including occupational safety)	**Construction Phase:** · Workplace situations · Implementation status of accident prevention measures	Supervising Consultant Contractor	Construction site	Visual observation and meeting with contractor	Daily
Other	Accidents	**Construction Phase:** · Implementation status of accident prevention measures	Supervising Consultant Contractor	Construction site	Visual observation and meeting with contractor	Daily
		Operation Phase:: · Number of traffic accident	GHA	In and around Tema intersection	Site survey and traffic accident data	Monthly or as needed for 2 years after completion

Annex 7 Environmental Monitoring Form

Draft Environmental Monitoring Form

Item	Parameter	Location	Frequency	Responsible Agency	Result
Construction Stage					
Air quality	PM10, PM2.5, NO, SOx	Construction site	1 time/half year	Supervising Consultant Contractor	
Noise and Vibration	Noise level Vibration Level	Construction site	1 time/half year	Supervising Consultant Contractor	
Water Quality	Turbid water	Construction site	Rainfall time	Supervising Consultant Contractor	
Waste	Waste disposal	Construction site	Every day	Supervising Consultant Contractor	
Operation Stage					
Air quality	PM10, PM2.5, NO, SOx	Tema Intersection	2 times/year	GHA	
Noise and Vibration	Noise level Vibration Level	Tema Intersection	2 times/year	GHA	

In case of reply, the number and date of this letter should be quoted

REPUBLIC OF GHANA

MINISTRY OF FINANCE

Our Ref: RMERD/TPU/JICA/019
Tel No: 0302-747197 Ext. 6122

23rd October, 2019

EXEMPTION OF LOCAL TAXES FOR THE PROJECT FOR REHABILITATION OF NATIONAL TRUNK ROAD N8 (PHASE 2) AND TAX EXEMPTION RELATED PROVISIONS IN GRANT AGREEMENTS BETWEEN THE GOVERNMENT OF GHANA AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Please refer to your letter dated 27th August, 2019 referenced JICA (GL) 8-27001/TPU/GEN/019 and subsequent discussions held on the subject matter above with the Honourable Minister of Finance and His Excellency the Japanese Ambassador to Ghana.

2. The Japan International Cooperation Agency (JICA) has been a valued partner to the Government of Ghana, and we have entered into numerous Exchange of Notes and Grant Agreements in pursuit of various developmental projects for which Ghana is thankful.

3. However, there has been an impasse between this Ministry and the Japan International Cooperation Agency (JICA) regarding the interpretation of tax related provisions in these Exchange of Notes and Grant Agreements.

4. This Ministry wishes to state that in order not to jeopardize the cordial relationship that already exist between the Governments 'of Ghana and Japan, we would use our best endeavours to ensure that all pipeline projects including the yet to be bided National Trunk Road N8 and the Tema Motorway Interchange Phase II projects, which are to be implemented with Japanese grant, receives Parliamentary approval for total tax exemption which shall include VAT, Personal Income and Corporate taxes, the main bone of contention between this Ministry and JICA

5. We count on your usual cooperation in this matter.

KWAKU KWARTENG, MP
DEPUTY MINISTER
FOR: MINISTER

THE DIRECTOR-GENERAL
FINANCIAL COOPERATION
IMPLEMENTATION DEPARTMENT
JAPAN INTERNATIONAL COOPERATION AGENCY

cc: Minister, MoF
Hon. Minister, MoFARI
Hon. Minister, Roads & Highways
Hon. Deputy Ministers, MoF
Chief Director, MoF
CEO, Roads & Highways Authority
Director, RMERD, MoF
Commissioner-General, GRA
Commissioners (Customs Div. & DTRD), GRA
Central Consultant Inc.
JICA Ghana Office

【Appendix-5】

Technical Notes

1st : 19 February, 2019

2nd : 11 June, 2019

JICA Survey Team
CTI Engineering International Co., Ltd.

Tachibana Annex Building
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TECHNICAL NOTES
ON
THE PREPARATORY SURVEY ON THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)

The Preparatory Survey Team commissioned to undertake the Outline Design (hereinafter referred to as "The Team") under Japan International Cooperation Agency (JICA) conducted field surveys and review of existing documents and held several discussions on the scope and basic policies with the Ghana Highway Authority (GHA), the executing agency and others concerned on the technical and other relevant aspects of "The Project for Improvement of Tema Motorway Roundabout (Phase 2), in the Republic of Ghana".

This note is signed between The Team, Ministry of Roads and Highways (MRH) and Ghana Highway Authority GHA) to share mutual understandings and agreement on the matters mentioned in Appendix-1.

Accra, 19 February 2019

Mr. Ernest Arthur
Chief Executive
Ghana Highway Authority (GHA)
Ministry of Roads and Highways

Dr. Takayuki Tsuchida
Chief Consultant
JICA Preparatory Survey Team

WITNESS:

Mr. Edmund Offei-Annor
Chief Director
Ministry of Roads and Highways

1. Project Background

The construction for the Project for Improvement of Ghanaian International Corridors (Grade Separation of Tema Intersection in Tema), hereinafter referred to as "Phase 1", commenced in February 2018 and the construction works are currently under progress. The completion is scheduled in June 2020. Major scopes of the Phase 1 covers widening and improvement of Accra – Tema Motorway and Aflao Road in the East-West direction (underpass), construction/widening of at-grade carriageway in the North-South direction, connecting ramps (slip roads) for right turning vehicles at all directions, at-grade traffic signal controlled intersection, and provision of pedestrian bridges.

According to the study conducted during Phase 1 outline design stage, the outcome of phase 1 improvement is effective until year 2023. Beyond 2023, the capacity of the intersection will start to decrease as it becomes saturated due to the increase of traffic volume and the intersection will start getting congested. In order that the intersection continues to enjoy safe and smooth flow, implementation of Phase 2, which plans to provide a fly-over in the north-south direction for the through traffics, needs to be completed before the intersection becomes saturated.

To ensure the intersection functions efficiently beyond 2023, the Government of Ghana (GOG) made a request to the Government of Japan (GOJ) for a Grant Aid Assistance to implement Phase 2. The GOJ decided to conduct the preliminary survey and examine the viability of the project and entrusted the Survey to Japan International Cooperation Agency (JICA).

2. General Items

2.1 Inception Report

The Team distributed and explained the contents of the Inception Report of the Project during the meetings held on January 15 and 16. MRH and GHA basically agree on its contents as also indicated in sub-clause 9-1 of the Minutes of Discussions signed between Ghana side and Japan side on January 18, 2019.

2.2 Project Scopes, Survey Objectives and Objective Section

1) Project Scopes

The requests made by the GOG are to construct a flyover at the Tema Motorway Roundabout and carry out the detailed design and construction supervision.

2) Survey Objective

The objective of the survey work is to:

- Understand the background, purpose, and scope of project under the Grand Aid Assistance Scheme of Japan,
- Study the feasibility of the project in terms of effectiveness, technical and economic justification,

for achieving the outcome of the assistance,

- Estimate project cost, and
- Propose the contents, implementation and maintenance plan as well as critical points to be undertaken by the GOG in order to achieve the outcome and targets set for the project

3. Technical Items Discussed and Agreed

3.1 Standards and Guidelines to be applied

Standards/guidelines applied during phase 1 and mentioned hereunder shall apply.

i) Highway Design: Ghana Road Design Guideline, Survey & Design Division, 1991

(Items not covered in the guideline will be referred from and in the order of " A Policy on Design of Highways and Streets, 2004" (AASHTO: American Association of State Highway and Transportation Officials) or Japan Road Structure Ordinance (Japan Road Association)

ii) Pavement Design: AASHTO Guide for Design of Pavement Structure, 1993

iii) Bridge/Structural Design: Specifications for Highway Bridges (Japan Road Association) or equivalent (wind speed/load will be based on Ghana standard, for live load refer to 3.5)

iv) Retaining Walls: Japanese Standard or equivalent

3.2 Road Geometric Design Condition

In order to secure consistency with Phase 1, the same design condition which was agreed during Phase 1 applies. The major conditions are given in Table 3-1.

Table 3-1 Road Geometric Design Condition

Item		Design Data
Design Speed		80 km/h (transition from NH to Urban Roads)
Design Vehicle Type		WB-20
Clearance Limit		Vertical 5.5 m (4.8 acceptable during construction) Horizontal 0.45m
Transverse Section Dimension	Carriageway Width	3.65 m
	Road Shoulder Width	Inner (0.5 m), Outer (2.5 m)
	Median Width	4.0 m (2.0m along flyover section)
No. of Lanes		2 lanes on each direction
Horizontal Alignment		Minimum Curve Radius : R=520 m Transition Curve Parameter: A=190
Minimum Curve Length		170 m (Minimum Transition Curve Length = 56 m)
Maximum Grade of Vertical Curve		Max 4.0 %
Radius of Vertical Curve		K-value on Crest Curve (64), K-value on Sag Curve (28)
Crossfall		2.5 % (Maximum Superelevation: 6.0 %)

3.3 Alignments

Construction of Phase 1 is based on the horizontal and the vertical alignments designed for the ultimate stage of improvement (3-tier intersection) during phase 1. Therefore, the alignments of Phase 2 are fixed and shall not be subject to significant change.

3.4 Number of Lanes

Number of lanes proposed during Phase 1 will be maintained, except at the at-grade intersection in the Aflao-Tema direction where it will be reduced to 2 lanes, given that the reduction can still be justified in terms of traffic capacity of the intersection.

3.5 Bridge/Structure Type of Elevated Section

- The elevated section on the north-south direction will consist of bridges and retaining walls.
- Cross section of the bridge (one direction) will be as shown in the figure below.

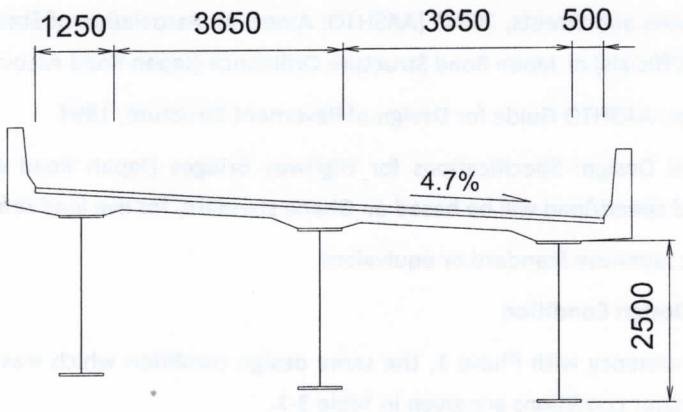

Figure 3-1 Cross section of Bridge (One direction)

- Bridge type and the layout of the fly-over are derived from the result of the comparative study. The Team explained on the configuration of the flyover that applies 3-column pier and 2-column pier. GHA and the Team agreed on the latter as it reduces the bridge spans and contributes to the cost.
- The Team also pointed out that the constraints (box culvert location, required vertical clearance, allowable vertical grades, minimization of impact to roads constructed in Phase 1 etc.) confines to application of steel type girders for superstructure and steel outer-rigger (gantry/gate) frame with concrete pier and caisson foundation. GHA has no objection with regards to application of such structures.
- The Team explained that the design calculation will be based on Japanese Standards as the steel plate girder or steel box girder is planned to be fabricated and procured from Japan.
- GHA understands and agrees to using the Japanese Standards for the bridge design, but GHA and The Team will agree on a safety factor that will not make the results of Japanese Standards inferior to the results of BS 5400 Code.

3.6 Pavement Design

- Asphalt concrete pavement will be planned both on standard section and on the elevated section including the bridges.

- Performance period for Phase 2 will tie into that of Phase 1 (2035).
- Performance period of the roundabout (final configuration of Phase 1) will be 2020.

4. Environmental and Social Consideration

- The EIA/IEE permit covers the overall improvement of Tema Motorway Roundabout (3-tier intersection) and not just the scopes of Phase 1 improvement works. Ghana`s prevailing environmental related laws do not require a separate EIA/IEE for projects implemented in phases, given that there is no drastic change in the existing conditions of the project site and/or in the plans/design in the phases.
- The existing permit`s validity is till June 4, 2019. GHA will take all necessary initiatives for the renewal of the permit until the completion of implementation of Phase 2.
- GHA will provide to the Team a carbon copy of letter(s) submitted for the renewal and the renewed permit immediately after obtaining the renewed permit.
- GHA will conduct stakeholders meeting in accordance with JICA Guidelines on environmental and social consideration.

5. Construction Planning and Procurement

- Vertical clearance of 4.8m is acceptable during construction period.
- A roundabout is one of the possible detours during construction that is deemed to minimize the impact to the roads constructed under Phase 1. The area within the roundabout can also be exclusively used for construction of the flyover.
- If the roundabout is to be applied for the detour, it will have sufficient or equal capacity as that of the signal-controlled intersection to control traffic until the commencement of Phase 2 construction. Should a roundabout is to be applied, GHA agrees on its application.
- Candidate locations for borrow pit and quarry sites are shown in Figure 7-1.
- Construction debris will be disposed at the disposal area designated by GHA. GHA is requested to provide information of the disposal area by the end of February, 2019.

6. Design Change

- Should a roundabout is to be applied for detour, GHA understands that change of final configuration of Phase 1 at-grade signal-controlled intersection into a roundabout needs a design change. In such case, GHA will submit the request for review of the modification accordingly.

7. Others

- GHA will furnish The Team with available data and information requested by the Team in the attachment (revised and submitted to GHA on February 13, 2019) of the Inception Report by its earliest possible convenience, but not later than March 31, 2019.

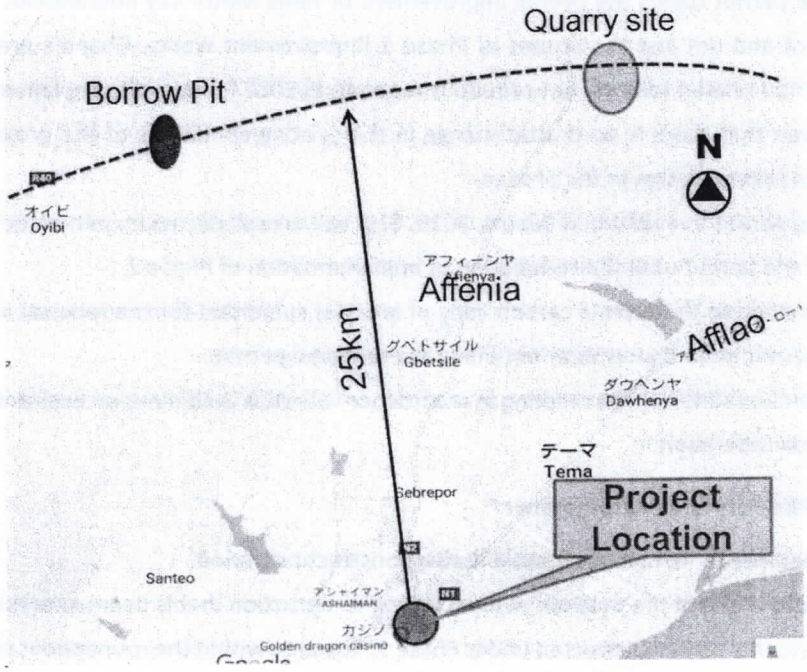

Figure 7-1 Candidate Location of Borrow Pit and Quarry Sites

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TECHNICAL NOTES (2)
ON
THE PREPARATORY SURVEY ON THE PROJECT FOR
IMPROVEMENT OF
TEMA MOTORWAY ROUNDABOUT (PHASE 2)

The Preparatory Survey Team commissioned to undertake the Outline Design (hereinafter referred to as "The Team") under Japan International Cooperation Agency (hereinafter referred to as "JICA") submitted outline design output and made presentations and held discussions with the Ghana Highway Authority (hereinafter referred to as "GHA"), the executing agency and others concerned as a part of the Design Review of the Ministry of Roads and Highways (hereinafter referred to as "MRH")/GHA on the technical and other relevant aspects of "The Project for Improvement of Tema Motorway Roundabout (Phase 2), in the Republic of Ghana" (hereinafter referred to as "The Project").

This note is signed between The Team, MRH and GHA on items discussed and agreed on the matters mentioned in Appendix-1.

Accra, June 11, 2019

Mr. Amin Baba Kassim Nuhu
Ag. Chief Executive
Ghana Highway Authority (GHA)
Ministry of Roads and Highways

ROBINSON SHRESTHA
for **Dr. Takayuki Tsuchida**
Chief Consultant
JICA Preparatory Survey Team

WITNESS:

Mr. Edmund Offei-Annor
Chief Director
Ministry of Roads and Highways

1. Project Background

The construction for the project for Improvement of Ghanaian International Corridors (Grade Separation of Tema Intersection in Tema), hereinafter referred to as "Phase 1", commenced in February 2018 and the construction works are currently under progress. The completion is scheduled in June 2020. Major scopes of the Phase 1 cover widening and improvement of sections of Accra-Tema Motorway and Aflao Road in the East-West direction (underpass), construction/widening of at-grade carriageway in the North-South direction, connecting ramps (slip roads) for right turning vehicles at all directions, at-grade traffic signal controlled intersection, and provision of pedestrian bridges.

According to the study conducted during Phase 1 outline design stage, the outcome of phase 1 is effective until year 2023. Beyond 2023, the capacity of the intersection will become saturated due to the increase of traffic volume and the intersection will start getting congested. In order that the intersection continues to enjoy safe and smooth flow, implementation of Phase 2, which plans to provide a fly-over in the North-South direction for the through traffics, needs to be completed before the intersection becomes saturated.

To ensure the intersection functions efficiently beyond 2023, the Government of Ghana (GOG) made a request to the Government of Japan (GOJ) for a Grant Aid Assistance to implement Phase 2. The GOJ through JICA decided to conduct the preliminary survey and examine the viability of the Project.

JICA dispatched a mission to Ghana in January 2019 (first field survey) to conduct a preliminary survey of Phase 2. During the course, JICA Survey Team (the Team) carried out surveys and meetings with GHA and mutually agreed on the design conditions for the outline design of the road and bridge design in the Technical Notes signed on February 19, 2019.

2. General Items

2.1 Design Review

The Team made presentations explaining the purpose of visit to Ghana, which was followed by an explanation on the output of the draft outline design, construction planning, traffic safety measures applied, importance of Building and Construction Information Modelling/Management (BIM/CIM) and a virtual simulation of the entire project.

2.2 Project Scopes, Survey Objectives and Objective Section

1) Project Scopes

The requests made by the GOG are to construct a flyover at the Tema Motorway Roundabout and carry out the detailed design and construction supervision.

2) Survey Objective

The objective of the survey work is to:

- Understand the background, purpose, and scope of project under the Grand Aid Assistance Scheme of Japan,
- Study the feasibility of the Project in terms of effectiveness, technical and economic

justification,

- Conduct outline design for minimum but optimal scope and scale of the project required for achieving the outcome of the assistance,
- Estimate project cost, and
- Propose the contents, implementation and maintenance plan as well as critical points to be undertaken by the GOG in order to achieve the outcome and targets set for the Project

3. Technical Items

3.1 1st Technical Note

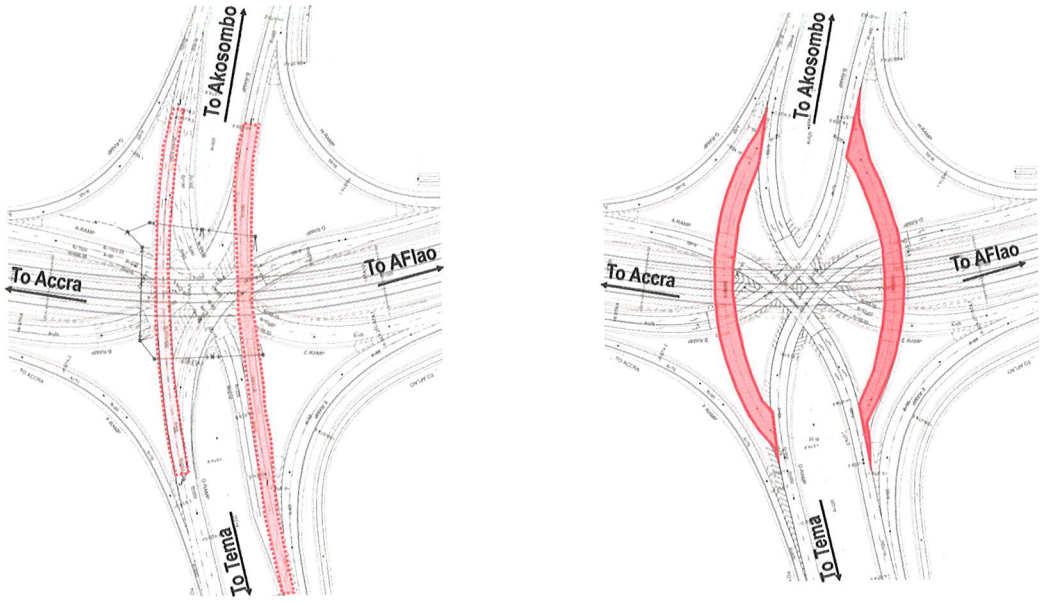
All items agreed in the 1st Technical Note signed on 19 February 2019, except for those covered in this technical note, still applies.

3.2 Response to Comments from GHA on Outline Design and Traffic Safety

GHA basically agreed on the contents of the output of the outline design and traffic safety plans presented by the Team during the technical meeting held on May 29, 2019, except for some concerns, which were compiled in the form of comments and provided to the Team on June 6, 2019. The response to the comments were furnished by the Team on June 7, 2019.

3.3 Design Change of Phase 1 Intersection Configuration

GHA has no objection on the changes proposed by the Team with regards to the configuration of the at-grade intersection of Phase-1 as illustrated in Figure-1 below.



Original Plan **Modified Plan**

Figure -1 Configuration Change of At-grade Intersection

3.4 Bridge Design Condition (Shoulder Width at Bridge Section)

GHA expressed concerns regarding 1.25m width for outer shoulders proposed by the Team at bridge section and demanded to increase to a minimum of 2.0m citing safety reasons, E.g. breakdown of vehicles.

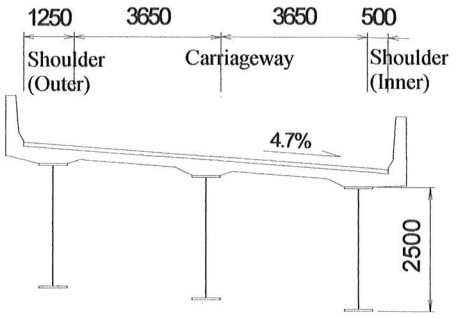


Figure-2 Cross section of Bridge Section

(Excerpt from Technical Note)

The Team explained 1.25m is the minimum width recommended in the Japanese Standard across longer bridges over 50m while AASHTO recommends 1.2m across bridges longer than 60m. This 1.25m width in combination with the proposed carriageway widths can secure enough space (2-lanes) to cater traffic smoothly and safely without being obstructed by a broken-down vehicle. This justification for application of 1.25m from safety and economic aspects was already provided and mutually agreed in the Technical Notes signed on February 19, 2019.

Subsequently, GHA agreed application of a 1.25m wide outer shoulder as proposed by the Team.

3.5 Bridge Design Condition (Live load)

GHA recommended to select the loading option that provided the worse effect as the loading selected by the Consultant gives a lesser load effect. The loading condition of live load, GHA recommends requires adding one lane with UDL fully loaded gives the load effect to approximately 8% higher than the Japanese B-Live Load. Previously the value was 6%. The Team will modify the value to be considered from 6% to 8%.

3.6 Bridge Material

GHA suggested the Team use concrete bridge pier instead of steel because of its durability and for easy maintenance. The Team explained that the steel girder and pier provided will be durable and its maintenance will not be a problem as a special type of steel (CORSPACE STEEL) will be used for construction that will require maintenance (painting) only in every 40 years. GHA agreed on the Material Choice for construction.

3.7 Seismic Design

GHA requested seismic design against large scale earthquake as required by the Building Code of Ghana in addition to the seismic coefficient 0.1. The Team will check on the necessity of the design and consult with JICA.

3.8 Others

- GHA requested the Team to provide a guideline for the maintenance of the proposed bridge. Preparation of a guideline is not under the present scope of this preparatory survey. The topic will be discussed with JICA.
- GHA assured the Team to provide land area sufficient for fabrication of steel girder for the construction of Phase 2.

R·S

END