AfDB and GHA

Consultancy Services for Detailed Engineering Design for Asutuare-Junction-Asutuare-Volivo Road (28.3km), Dufor Adidome-Asikuma Junction (38.4km) & Asutuare-Aveyime Road (24.0km)-Lot-1, Ghana

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

MSV INTL USA, KE&T & OWU CONSULT GH

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1 Introduction

This ESMP details the significant environmental and social baseline conditions within the project's sphere of influence and the risk assessment of the key potential environmental and social impacts identified to be associated with the proposed project component activities. Mitigation measures have been designed and incorporated to manage the identified limited, localized and residual impacts with budgetary allocation to ensure their effective implementation. Moreover, information on stakeholder identification, analysis and engagement process has been discussed in this document as well. Disclosure have also been made in this ESMP to capture the institutional capacity building, strengthening and implementation plans for the Bank's safeguards capacities to ensure effective management of the mitigation and monitoring programs.

1.1 Objectives of the ESMP

The ESMP aims to bring the project into compliance with applicable national environmental and social legal requirements and the Bank's safeguards policies and procedures. The major objectives of the ESMP are as follows:

- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts.
- To enhance the project beneficial environmental and social impacts.
- To address capacity building requirements to strengthen the Bank's safeguards capacities where necessary.
- To specify the environmental and/or social loan conditions or covenants that are part of the project loan agreements to ensure that the project meets the Bank's safeguards requirements.

2 Context

This section describes project activities and major environmental and social components that will likely be affected positively or negatively by the project. Moreover, the existing interaction among the physical, biological/ecological and social processes has been described under this section. Detailed information of the project context has been disclosed in the ESIA Report.

2.1 Project Background

The Proposal has the following background information: (i) the Eastern Corridor (N2) is an alternative international transit route identified by the Government of Ghana (GOG) to facilitate transit and trade; (ii) the GOG sought for and obtained support from the Japanese Government to develop the N2; (iii) JICA undertook a feasibility study and established that the implementation of N2 is feasible; (iv) GOG now intends to develop the N2 based on JICA's feasibility studies and designs; (v) JICA's feasibility studies and design yielded five alternative road alignments (see map); (vi) JICA's preliminary road alignment (alternative 3) was selected by the Client for further studies and development (see map).

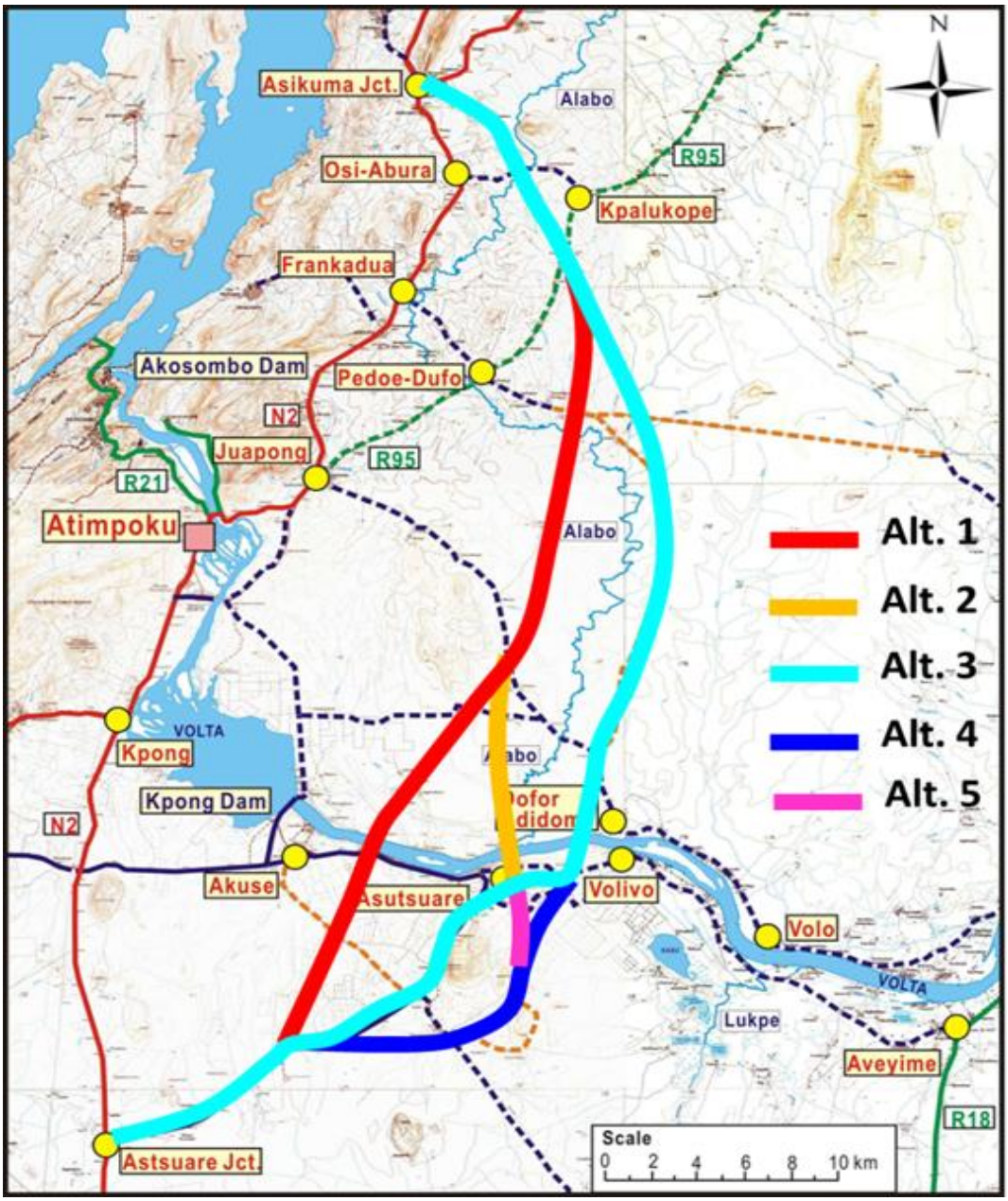


Fig 1 - Alternative Routes Provided by JICA

2.2 Project Location

The Eastern Corridor which lies to the east of the country, and approximately 695 km in length commences from Tema Roundabout through some important towns in the Greater Accra, Volta, Northern Regions and ends at Kulungugu in the Upper East Region of the country. This corridor is about 200km shorter than the Central Corridor but has a substantial portion unpaved with ageing bridges and experiences washouts and damages during the rainy season making travel difficult. The GoG intends to develop a targeted section of the Eastern Corridor which traverses eight (8) districts and one (1) metropolis in three (3) regions. Therefore, the project zone will cover the following districts: Yilo Krobo, Manya Krobo, Asuogyaman (in the Eastern Region); Dangme West and Dangme East (in the Greater

Accra Region); South Tongu, North Tongu, Adaku-Anyigbe (in the Volta Region) and Ho metropolis (in the Volta Region).

The Proposed Project Roads are the following:

- **Section 1: Asutuare Junction – Volivo (28.3km)**

This 28.3km road branches eastwards from Tema-Akosombo road at Asutuare Junction and passes through agricultural and commercial towns/villages in the Eastern region to Volivo. The surface is generally gravel but it has some sections paved. The road is of width 7.3m, at the paved section and of lower width at the unpaved sections.

- **Section 3: Dufor Adidome – Asikuma Junction (38.4km)**

This section currently does not exist and would have to be built through a virgin area. Preliminary road alignment has been developed by the consultant who was engaged for the feasibility study of the road and can be made available.

- **Section 2: Asutuare-Aveyime Road (24km)**

This 24km section stretches southwards from Asutsuare through agricultural and commercial towns/villages in the Volta region to Aveyime. The road is gravel surfaced and is distressed in sections. The road is of width 7.3m.

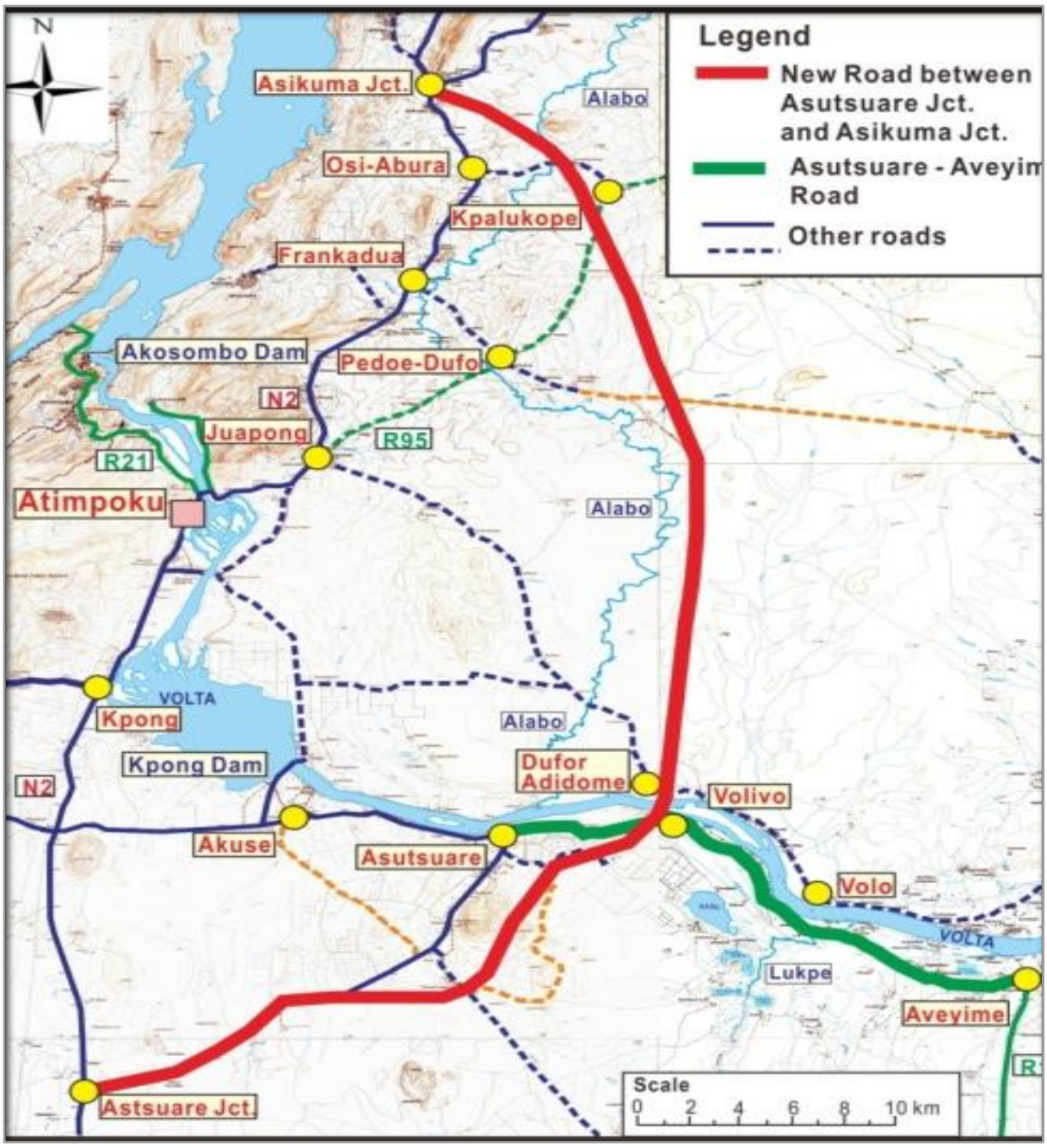


Fig 2 – Map Showing the Selected Alignment

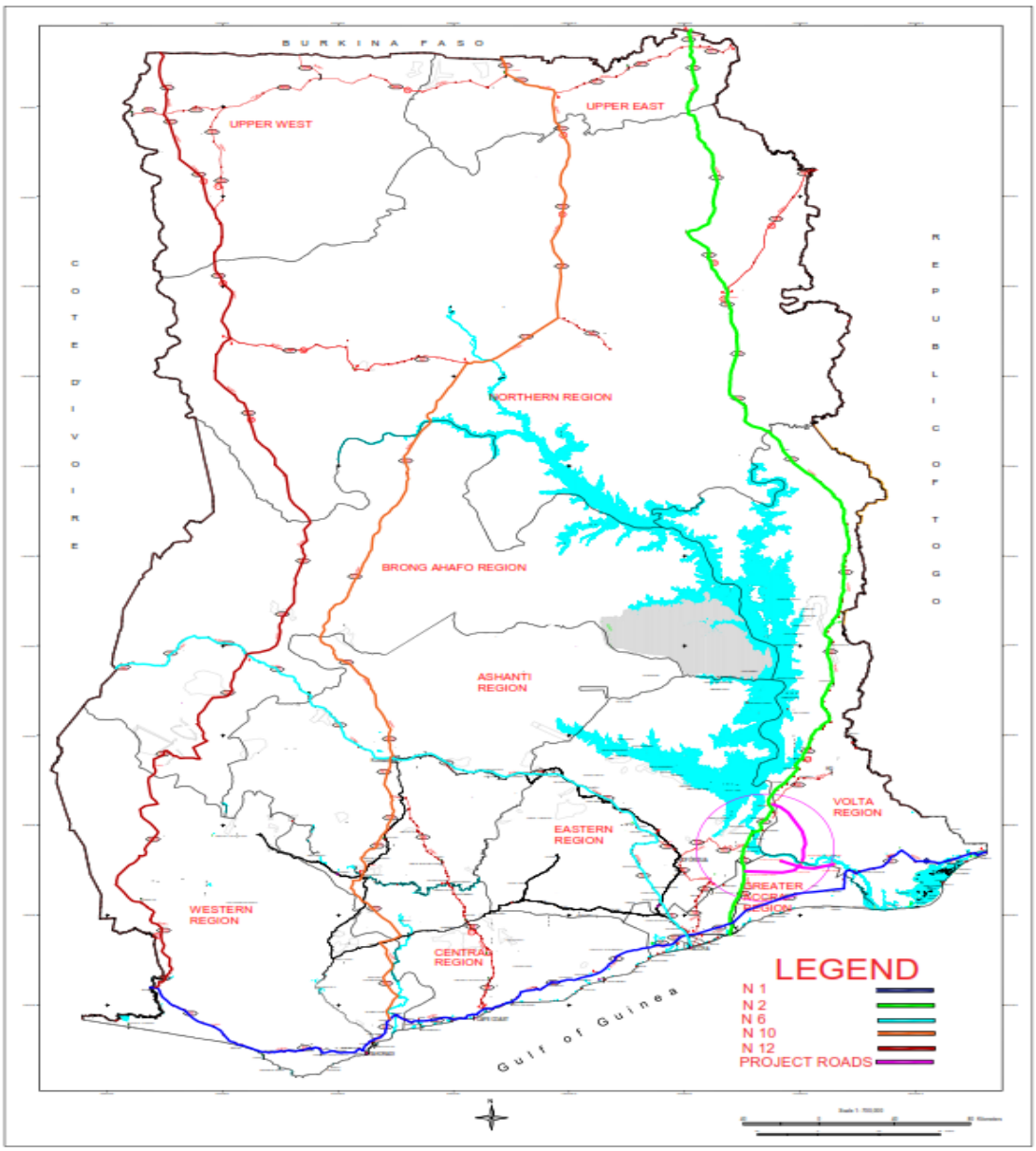


Fig 3 – Ghana Map Showing Connectivity Between Project Roads and the National Road Network

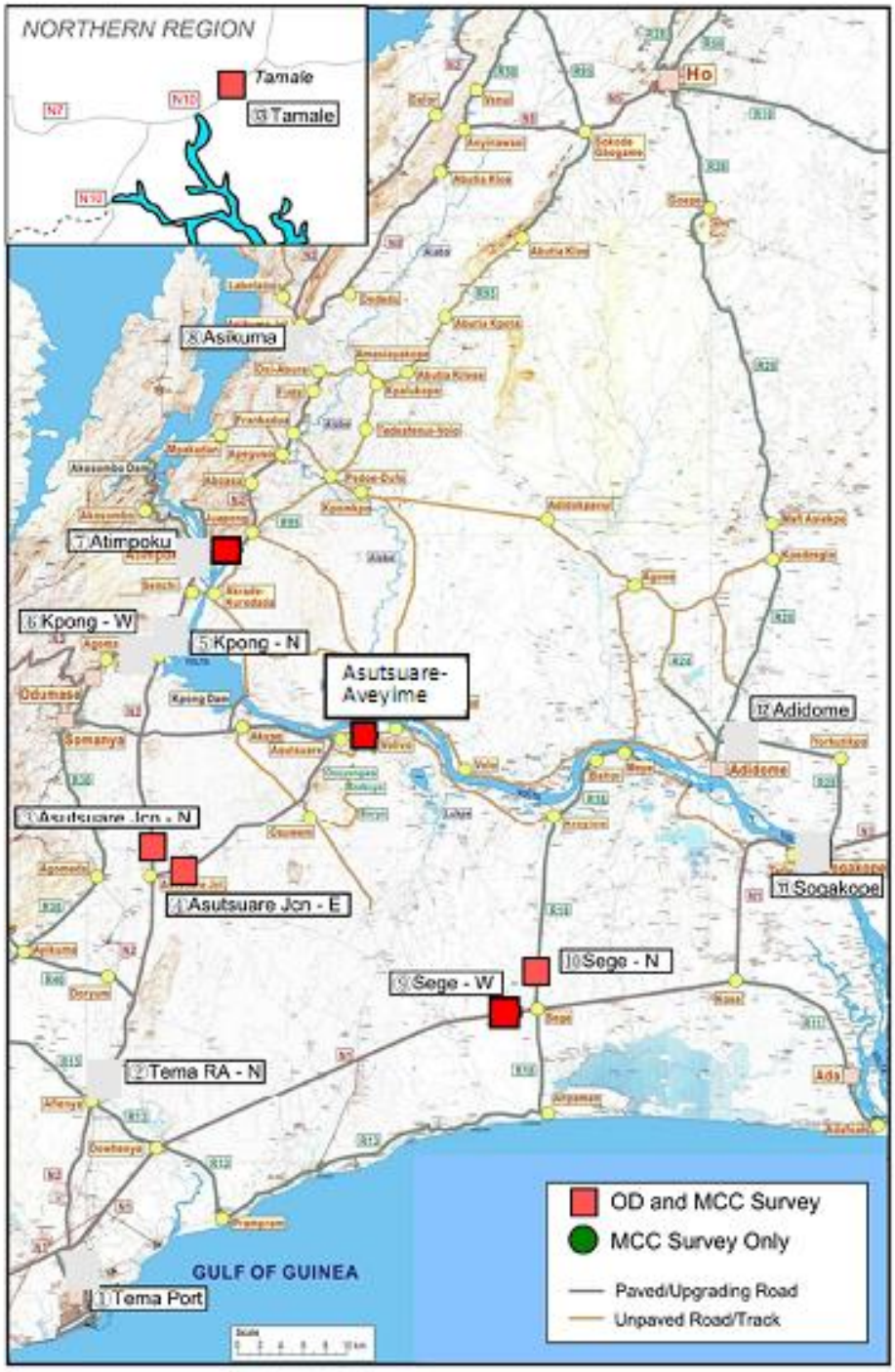


Fig 4 – Classified Manual Counts (MC) and Origin-Destination (OD) Surveys Census Locations

2.3 Project Components

As three (3) sections of the Eastern Corridor International Transit Route form the main components of the Project, there are other sub-project within the overall context of Eastern Corridor Proposal, consisting of the following components (See Table 1.0):

Table 1.0 Project Components

Serial Number	Component Name	Estimated Cost (USD or GHc)	Component Description
1	Road Construction Civil Works	USD 129,786,847.66	(i)Construction Civil Works (Section 1): Asutuare Jn – Volivo Road. (ii)Construction Civil Works (Section 3): Dufor Adidome – Asikuma Jn Road. (iii)Construction Civil Works (Section 2): Asutuare – Aveyime Road. The following are included: (iv)Drainage, traffic studies, geotechnical bridges and interchange, pavement designs.
2	Road Safety	USD 155,744.22	Roads safety awareness and education campaign targeting children. Cyclists, pedestrians, especially women and bus/taxi/okada (motor-cycle taxis) operators.
3	HIV/AIDS/STI/TB/Malaria/Ebola/Cholera Mitigation	USD 129,786.85	HIV/AIDS/STI and others awareness and prevention programs. The program will target construction workers, the communities along the Eastern Corridor and long-haul truck drivers.
4	ESMP Implementation	USD 6,489,342.38	Environmental and social mitigation measures over and above those included in the Bill of Quantities, ie. (i)off-road environmental and social protection activities and (ii)complementary activities such as tree

			planting, water provision, etc. It is estimated that 16ha of trees will be planted under the Project (40.59 acres of bare land will be appropriated under RoW acquisition).
5	Gender Component	USD 804,678.45	Gender sensitization and capacity building of community- based organizations.
6	Compensation and Resettlement of PAPs	GHc 26,292,463.89	Provision of adequate compensation and relocation/resettlement of PAPs identified in the ESIA and FRAP documents.
7	Consulting Services	USD 1,064,252.15	(i)Consulting services for construction supervision of civil works. (ii)Consulting services for Project Technical and Financial Audit.
8	Institutional Support and Capacity Development Component	USD 194,680.27	Consulting services for: (i)Preparation of Bidding Documents and Bid Evaluation assistance, as well as contract management assistance. (ii)Design of a Project Performance Monitoring System (PPMS) for Project impact monitoring. (iii)Enhancing GHA's Project Management capacity (preparation of BDs and procurement (contract management, including cost control) (iv) capacity development at national and district/municipal assemblies levels.

Source: K E & T Data Records

2.4 Project Description

2.4.1 Field Study Findings of Proposed Alignments (Sections 1 and 3)

- **Section 1: Asutuare Jn – Volivo Road (28.3km)**
- **Section 3: Dufor Adidome – Asikuma Jn (38.4km)**

2.4.1.1 Hydrological and Drainage Conditions of Sections 1 and 3

There are 2No. Pipe Culverts and 9No. Box Culverts as definite drainage arrangements within the entire Section 1 of the proposed road. On the other hand, there are no pipe culverts nor box culverts adorning Section 3 of the proposed project road. Instead, River Volta, River Alabo and tributaries of River Lomen cross Section 3 of the proposed project road. The existing drainage structures within Section 1 are structurally weak with inadequate hydraulic capacities, therefore, would have to be demolished and replaced. **See Table 2.0.**

Table 2.0 Hydrological/Drainage Findings for Sections 1 and 3 of Project Roads

Serial Number	Number Existing (No.)	Description	Comments
1	2	Pipe Culverts	Demolish and Replace on Section 1 Project Road.
2	9	Box Culverts	Demolish and Replace on Section 1 Project Road.
3	-	River Volta; River Alabo and Tributaries of River Lomen	Main Rivers Crossing Section 3 of the Project Roads.

Source: K E & T Design Document

2.4.1.2 Traffic Studies of Sections 1 and 3 Catchment Zone

The Classified Manual Counts (MC) and Origin-Destination (OD) surveys were conducted on the respective road sections within the Sections 1 and 3 project roads catchment zone and shown in **Table 3.0.** This information was used in pavement design. The census locations are shown in **Figure 5.**

Table 3.0 Traffic Studies and Results for Sections 1 and 3 Project Roads

Serial Number	Road Section	ADT	AADT
1	Asutuare East – Asutuare Junction	550	528
2	Sege West - Battor	1,506	1,446
3	Sege North - Tema	5,612	5,387
4	Asutuare North – Kong	3,508	3,368
5	Juapong - Atimpoku	2,836	2,723
6	Bunso – Osino	8,740	8,827

Source: K E & T Design Documents

2.4.1.3 Geotechnical Investigations Results for Sections 1 and 3 of Project Roads

The subgrade and existing pavement conditions were investigated. The results were as follows:

- Subgrade CBR ranges from 8% to 20%

- A design CBR of 12% was used for pavement design

Black cotton clay was located at the following chainages and recommended to be removed to the stated depths below:

- CH. 10+800 – CH. 28+245 (1.5m deep)
- CH. 28+700 – CH. 48+000 (2.0 m deep)

2.4.1.4 Bridge Site Investigations for Sections 1 and 3 of Project Roads

The allowable bearing capacities and foundation depths are indicated below:

- Allowable Rearing Capacities obtained range from 200kPa to 290kPa
- Recommended Foundation depths range between 3.0m and 3.5m

2.4.1.5 Construction Materials Survey for Sections 1 and 3 of Project Roads

The construction materials survey and findings are shown in **Table 4.0.**

Table 4.0 Construction Materials Surveys and Findings

Serial Number	Construction Materials Type	Location Obtainable	Comments
1	Sand	Volta River at Asutuare; Aveyime and Battor.	For Concrete Works
2	Rock Aggregates	Eastern Quarries; Bigleb Quarry; Rockshell Quarry and Mafi-Kpedzi Outcrop	For Concrete and Road Surfacing
3	Gravels	Afienya and Its Environs.	Quality Gravel.

Source: K E & T Design Documents

2.4.2 Detailed Engineering Designs for Sections 1 and 3 of Project Roads

2.4.2.1 Geometric Design for Sections 1 and 3 Project Roads

The detailed geometric engineering design for sections 1 and 3 of the project roads is shown in **Table 5.0.**

Table 5.0 Geometric Design for Sections 1 and 3 Project Roads

Design Parameters	Roads Classification	Design Speed	Minimum Radius (m)	Minimum Arc Length (m)	Minimum Curve (m)	Minimum K Value (Crest)	Minimum K Value (Sag)
-	National Road	100km/h	-	-	-	-	-
Horizontal Design	National Road	100km/h	694.495	170.0	-	-	-
Vertical Alignment	National Road	100km/h	-	-	85	64	28

Source: K E & T Design Documents

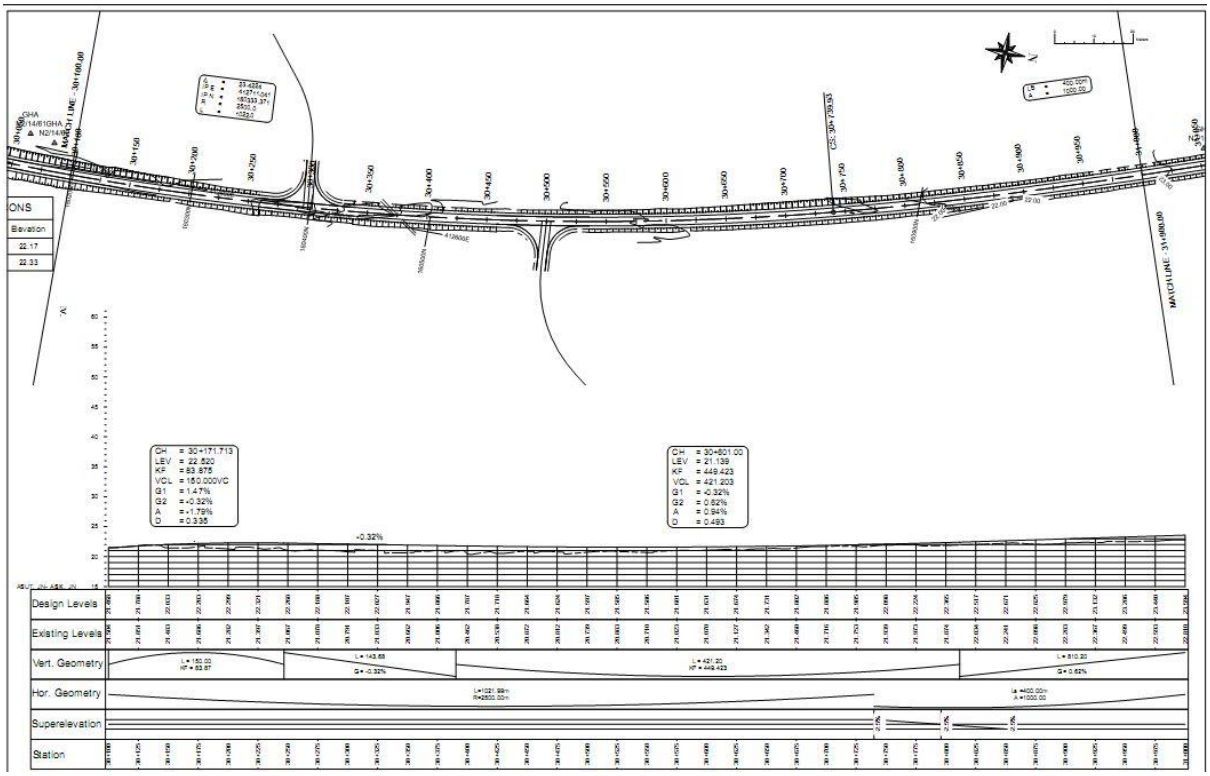


Figure 5 Sample Road Plan and Profile for Sections 1 and 3 Project Roads

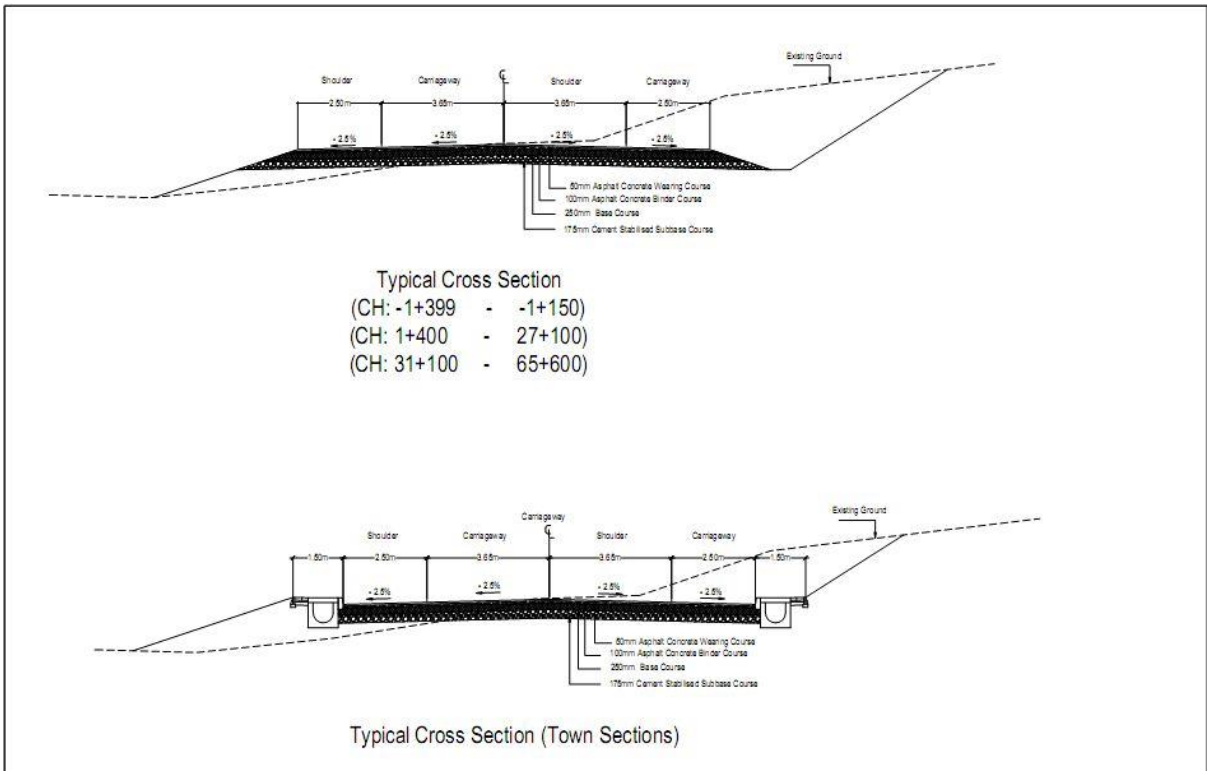


Figure 6 Typical Cross-Sections of Project Roads 1 & 3

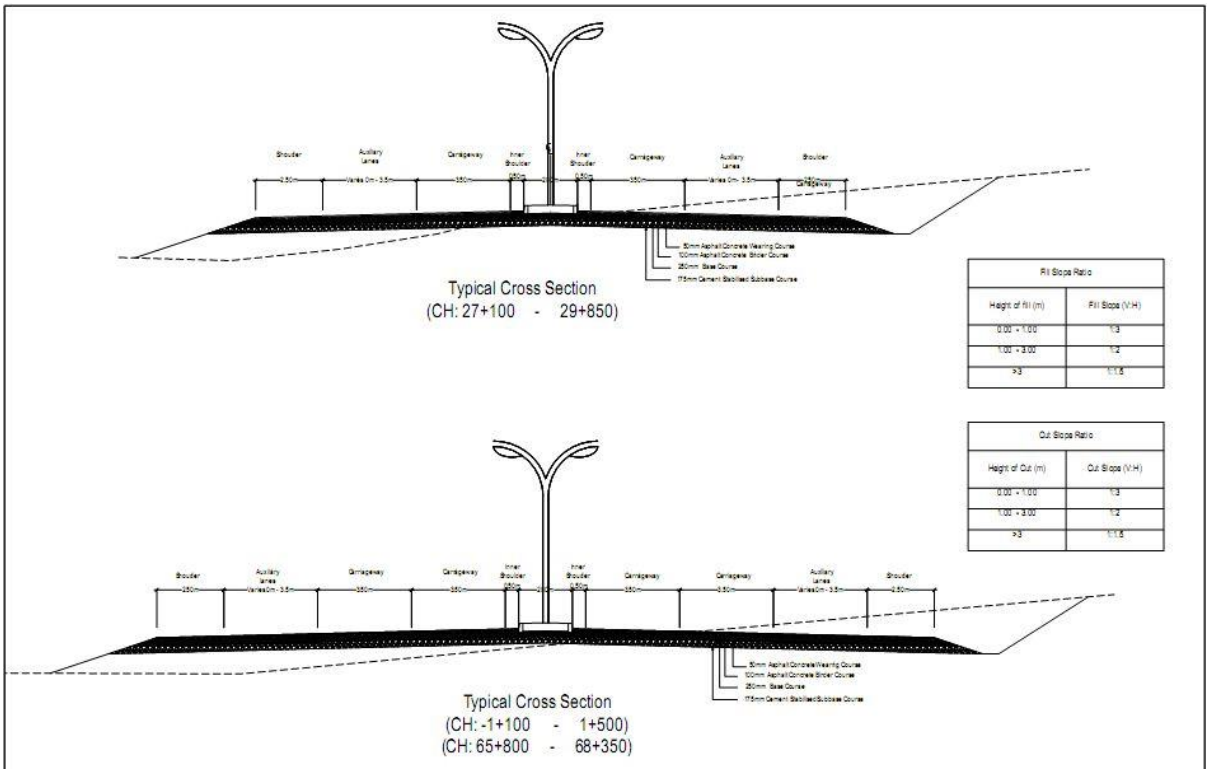


Figure 7 Typical Cross-Sections of Project Roads 1 & 3

2.4.2.2 Pavement Design for Sections 1 and 3 Project Roads

The following data was used for the pavement design of Sections 1 and 3 of the project roads:

- The subgrade strength (CBR) of 8%
- The cumulative number of equivalent standard axles (28,056,869) that will use project roads over the 20-yaer design life.

Pavement structure design utilized the following recommended data:

- 50mm asphaltic concrete wearing coarse
- 100mm asphaltic concrete binder
- 250mm crushed stone base
- 175mm granular sub-base

2.4.2.3 Drainage Design for Sections 1 and 3 Project Roads

The drainage design for hydrological structures for sections 1 and 3 of the project roads is shown in **Table 6.0.**

Table 6.0 Drainage Design for Sections 1 and 3 of Project Roads

Serial number	Chainage (km)	Structure Type	Span (m)	Comments
1	7 + 200	Bridge	15	Over River Dawhe for Section 1 Project Road
2	23 + 230	Bridge	45	Over Irrigation Canal for Section 1 Project Road
3	33 + 150	Bridge	15	Over Tributary of River Alabo for Section 3 Project Road
4	49 + 850	Bridge	15	Over Tributary of River Alabo for Section 3 Project Road
5	61 + 000	Bridge	60	Over River Alabo for Section 3 Project Road
6	63 + 025	Bridge	90	Over River Alabo for Section 3 Project Road
7	28 No.	Box Culverts	-	Selected locations for Sections 1 and 3 Project Roads
8	9 No.	Pipe Culverts	-	Selected locations for Sections 1 and 3 Project Roads

Source: K E & T Design Documents

2.4.3 Changes to JICA Design by Client

After presentation of the Interim Design Report by Consultant to the Client, the following design changes were made to incorporate the following features and new scope of works:

- Replacement of four (4No.) Rotary Roundabouts in the JICA design.
- Redesign and installation of four (4No.) Grade-Separation Interchanges.
- Design Consultants extra works in redesigning of four (4No.) Rotary Intersections into Interchanges through new topographic surveys, geotechnical investigation, geometric design, bridge design and cost estimation.
- Design Consultants undertook re-alignment of Section 1 of the project road around Golden Exotic Farms to avoid the Paddy Rice Farms and Irrigation Canals and provide a link to the farms.

The New Interchanges Designed are:

- Asutuare Junction Interchange at CH. 1 + 425 (Section 1 of Project Road)
- Volivo Interchange at CH. 29 + 095 (Section 1 of Project Road)
- Dufor Adidome Interchange at CH. 30 + 700 (Section 3 of Project Road)
- Asikuma Junction Interchange at CH. 68 + 625 (Section 3 of Project Road)

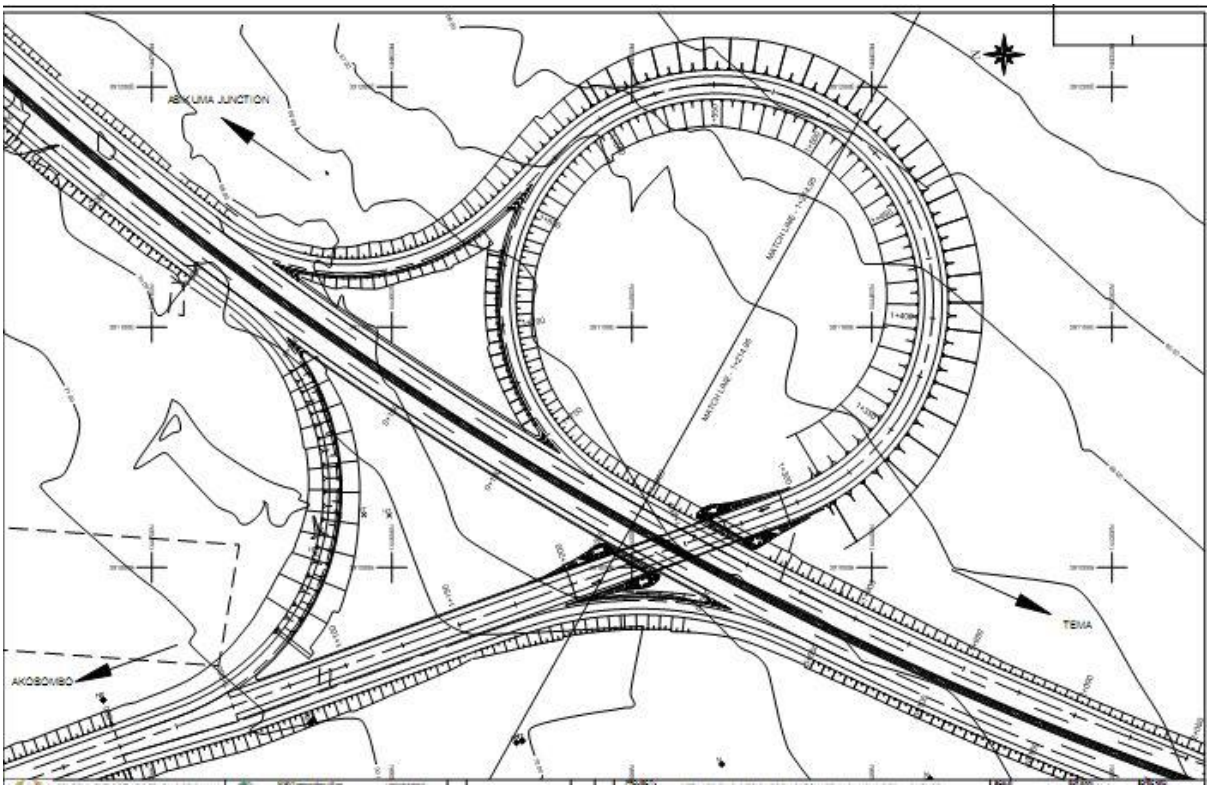


Figure 8 Layout of Asutuare Jn Interchange CH. 1+245

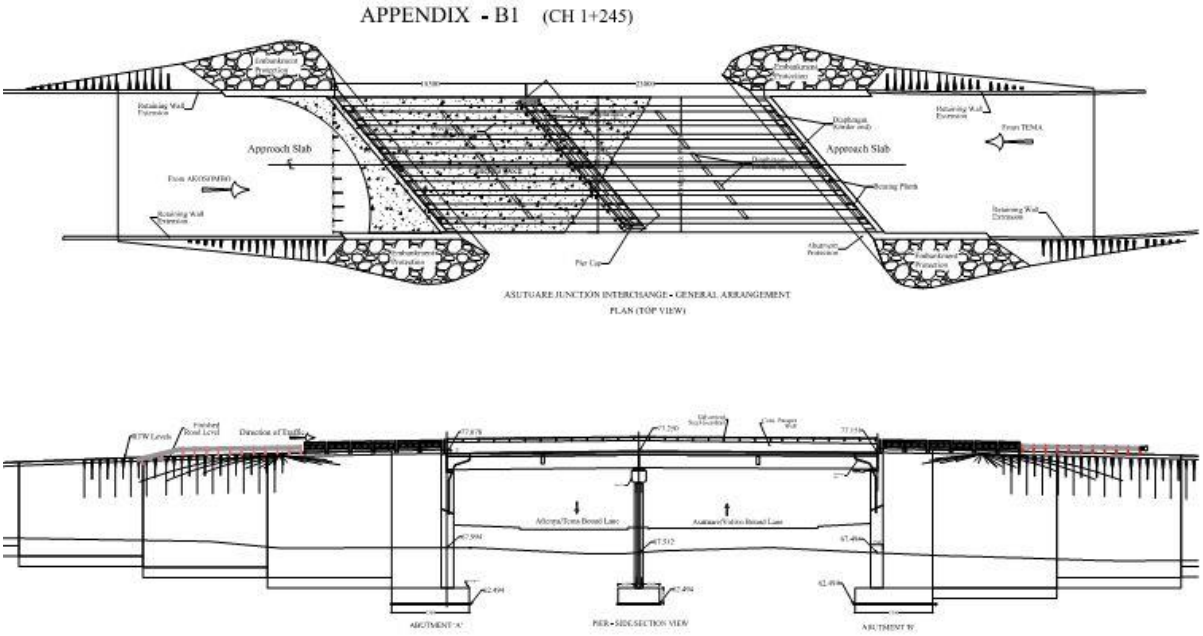


Figure 9 Bridge at CH. 1+245 (The Asutuare Interchange on Section 1 Project Road)

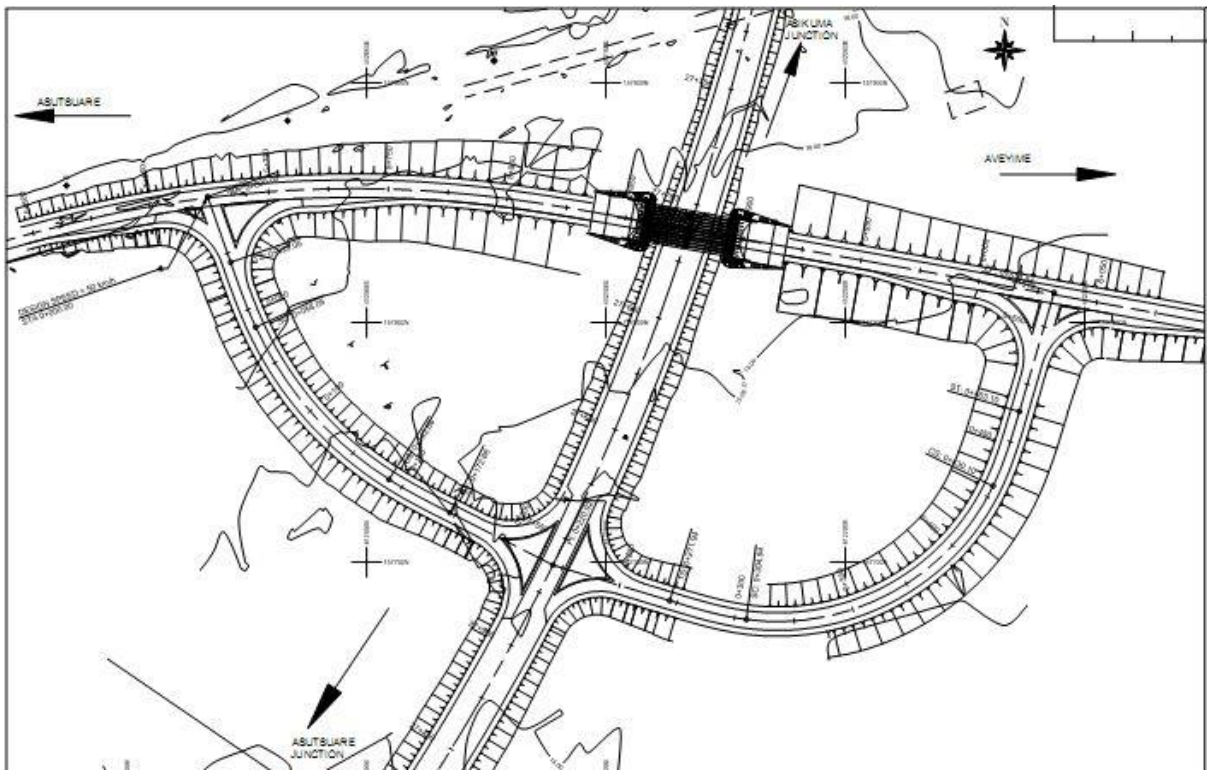


Figure 10 Layout of Volivo Interchange at CH. 29+350 on Section 1 Project Road

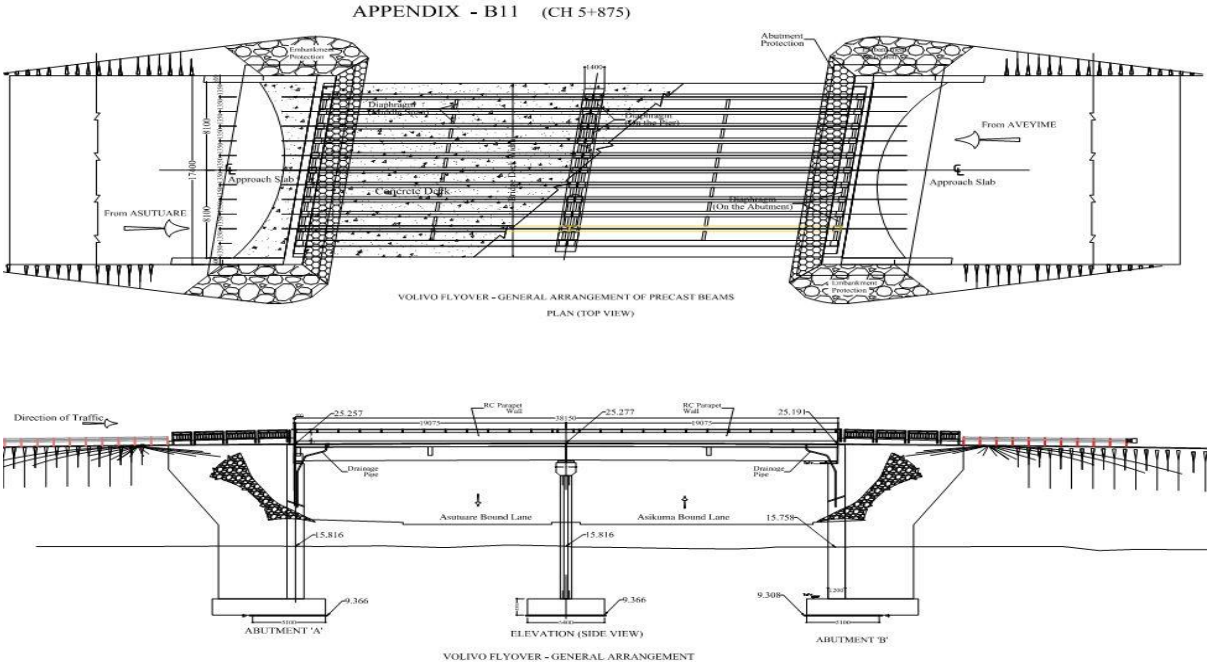


Figure 11 Bridge on Volivo Interchange at CH. 29+350 on Section 1 Project Road

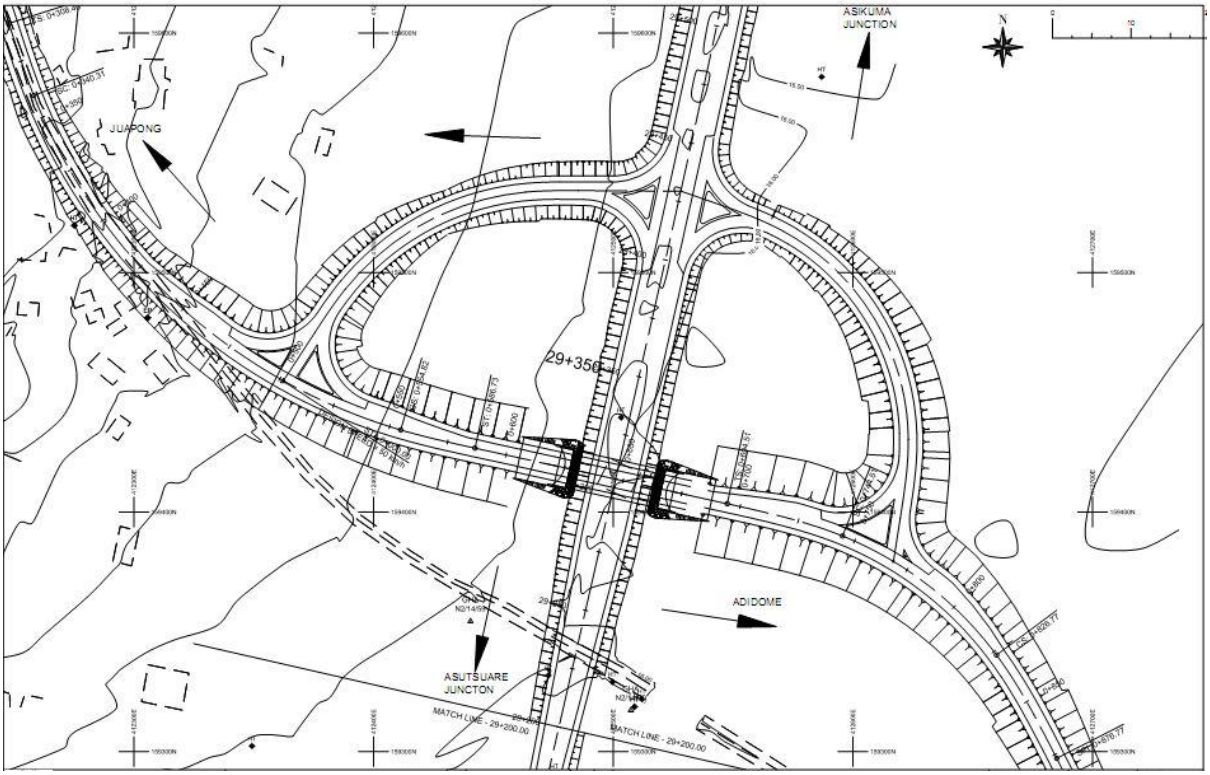


Figure 12 Layout of Dufor Adidome Interchange CH. 29+350 on Section 3 Project Road

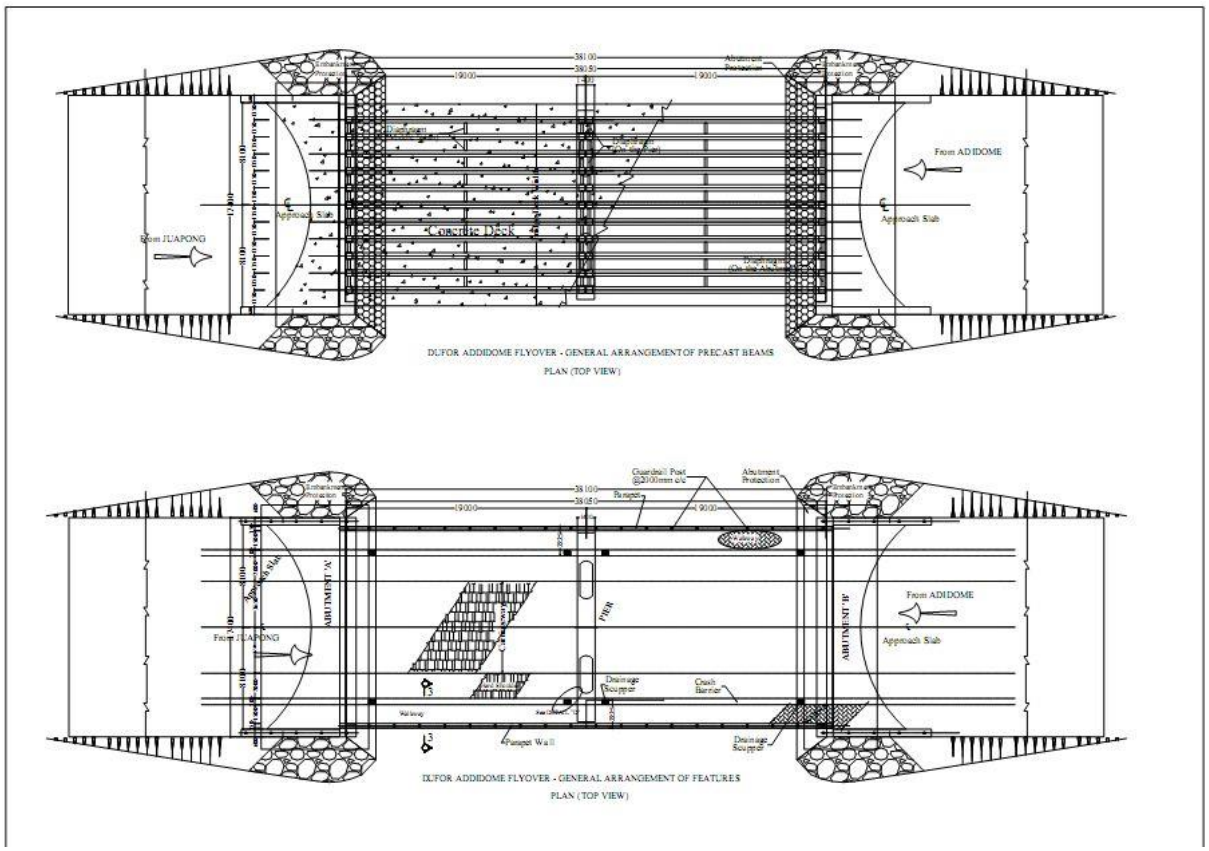


Figure 13 Bridge on Dufor Adidome Interchange CH.29+350 on Section 3 Project Road

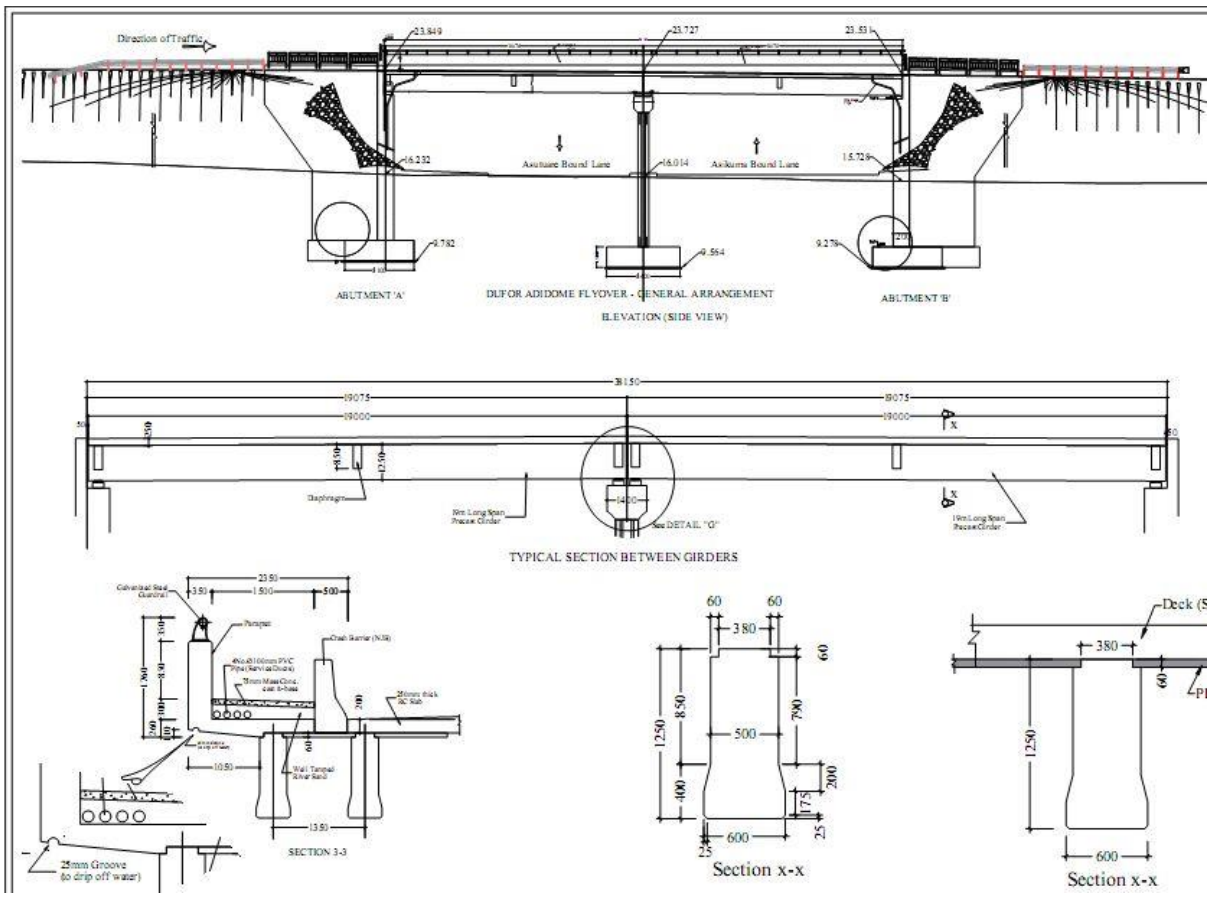


Figure 14 Bridge on Dufor Adidome Interchange CH. 29+350 on Section 3 Project Road

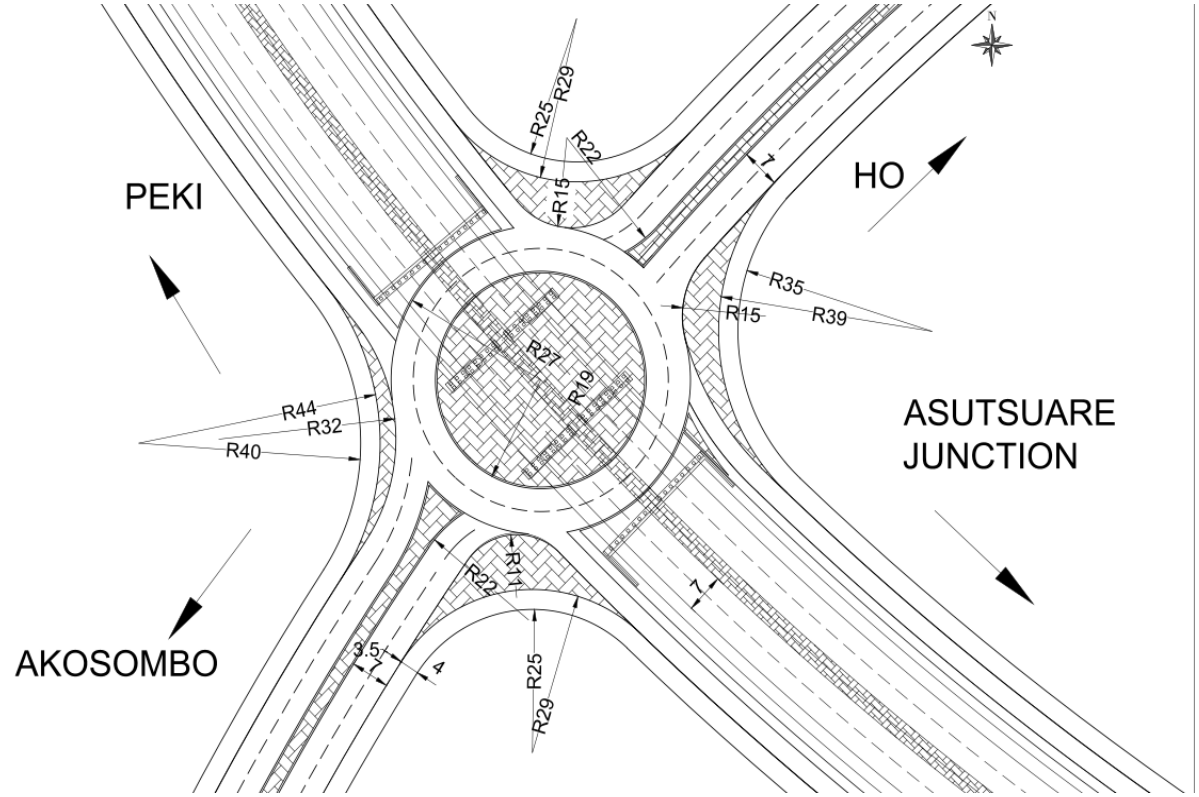


Figure 15 Layout of Asikuma Jn Interchange CH. 67+ 200 of Section 3 Project Road

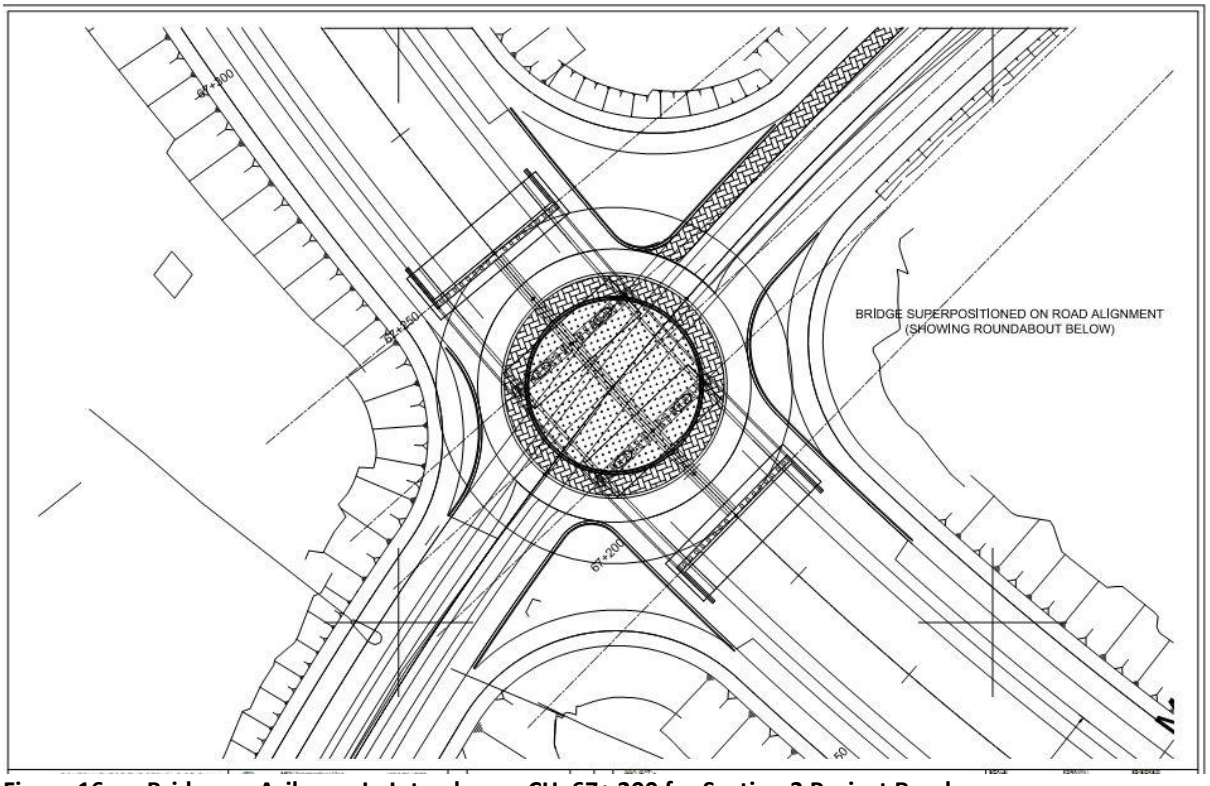


Figure 16 Bridge on Asikuma Jn Interchange CH. 67+ 200 for Section 3 Project Road

2.4.4 Additional Changes to Engineering Design by Client

The client made additional changes to the engineering design after presentation of the final design report with new cost estimates. Details of the new engineering design changes were as follows:

- Section 1 Project Road alignment be revised to avoid the black cotton clay section between CH. 11+700 – CH. 23+000
- The pavement design reviewed from asphaltic to double bituminous surfacing
- Drainage structure types be reviewed to save cost

2.4.4.1 Revised Final Drainage Structures Design for Sections 1 and 3 Project Roads

The revised final drainage structures design for Sections 1 and 3 project roads is shown in **Table 7.0** at selected sections of project roads 1 and 3.

Table 7.0 Revised Final Drainage Structures Design for Sections 1 and 3

Serial number	Quantity	Pipe Culverts	Quantity	Box Culverts
1	7	1/0.9m Diameter	2	2/2.0m x 2.0m
2	3	2/0.9m Diameter	2	3/2.0m x 2.0m
3	9	1/1.2m Diameter	1	3/2.0m x 3.0m
4	3	2/1.2m Diameter	1	4/2.0m x 2.0m
5	8	2/1.8m Diameter	1	4/4.0m x 2.5m

Source: K E & T Design Documents

2.4.4.2 Final Pavement Structures Design for Sections 1 and 3 Project Roads

The following recommendations have been made for Sections 1 and 3 project roads:

- Recommended for Section 1 (Asutuare Jn – Volivo Road):
  - ❖ Double Surface Dressing:
    - ➢ 150mm Mechanical Stabilized National Gravel Base Course
    - ➢ 200mm National Gravel Sub-base
    - ➢ 600mm Selected Fill
- Recommended for section 3 (Dufor Adidome – Asikuma Jn Road):
  - ❖ Double Surface Dressing:
    - ➢ 150mm Mechanical Stabilized National Gravel Base Course
    - ➢ 200mm National Gravel Sub-base
    - ➢ 600mm Selected Fill

2.4.4.3 Final Bridges Structure Designs

The final bridges structure designs will be at the following chainages:

- CH. 8+600 – Over River Dawhe on Section 1 project road
- CH. 24+825 – Over Golden Exotic Irrigation Canal and Road on Section 1 project road

- CH. 25+850 – Over Irrigation Canal on Section 1 project road
- CH. 34+550 – Over Tributary of River Alabo on Section 3 project road
- CH. 51+242 – Over Tributary of River Alabo on Section 3 project road
- CH. 62+583 – Over River Alabo on Section 3 project road
- CH. 64+425 – Over River Alabo on Section 3 project road

The revised final design alignment maps are shown below:

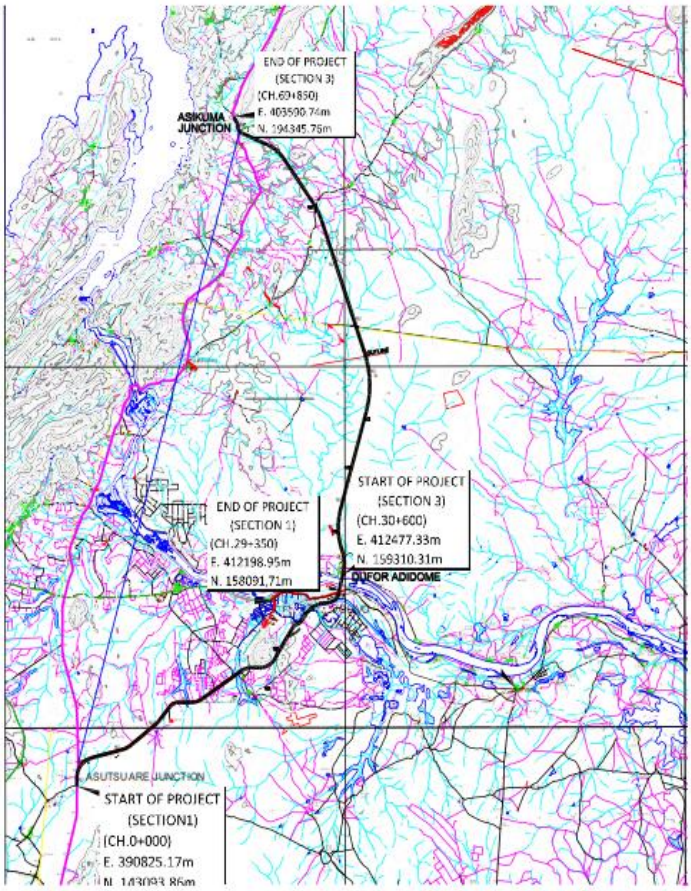


Figure 17 Final Alignments for Sections 1 and 3 Project Roads

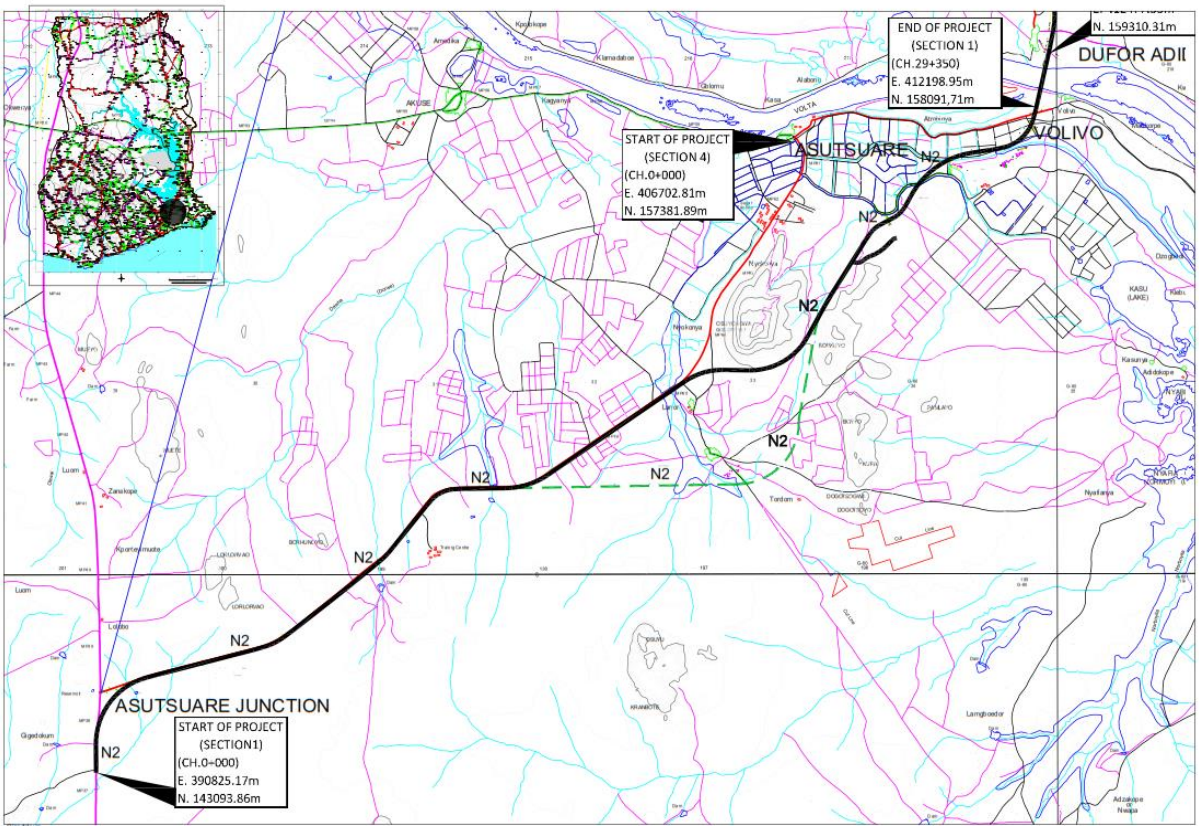


Figure 18 Final Alignment for Section 1 Project Road

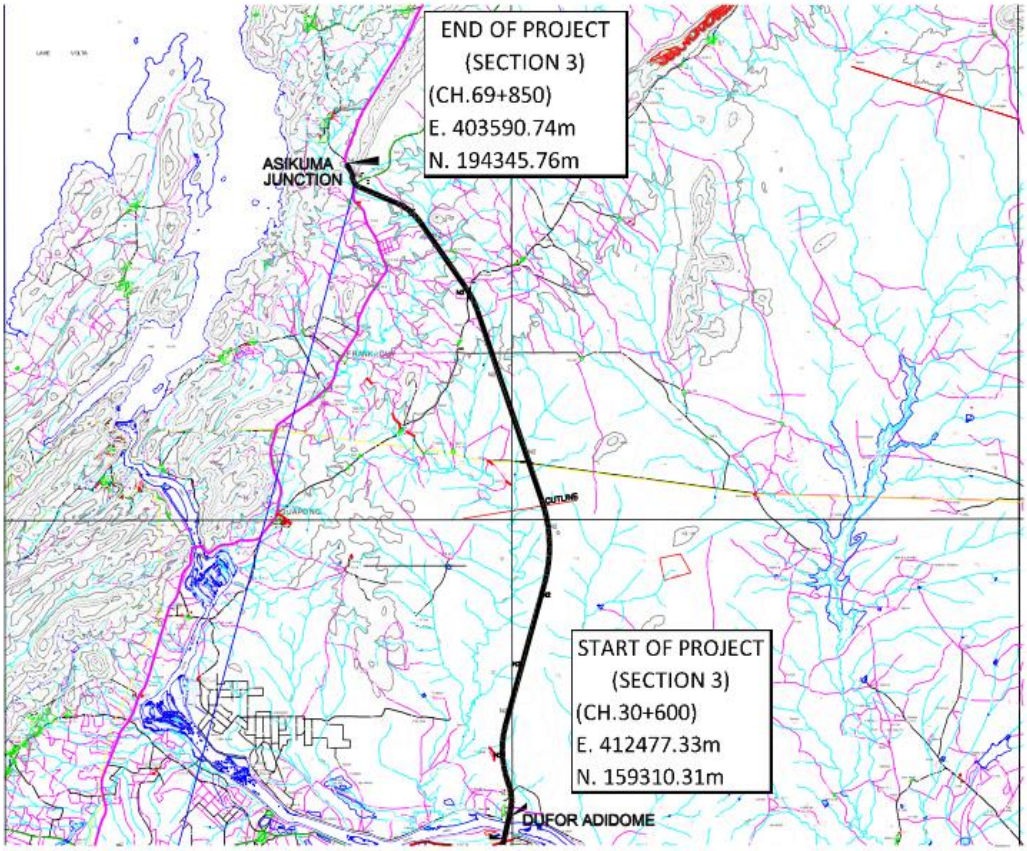


Figure 19 Final Alignment for Section 3 Project Road

2.4.4.4. Revised Final Cost Estimate for Sections 1 and 3 Project Roads

The revised final cost estimate for Sections 1 and 3 project roads is indicated in **Table 8.0**

Table 8.0 Final Cost Estimate for Section 1 and 3 Project Roads

Project Road Section	Original Cost (USD)	Revised Final Cost (USD)	Difference in Cost (USD)
1	135,701,562.37	42,797,472.46	92,904,089.91
3	180,960,800.70	44,682,266.78	136,278,533.92
Total	**316,662,363.07**	**87,479,739.24**	**229,182,623.83**

Source: KE&T Design Documents

2.4.5 Field Study Findings of Proposed Alignment (Section 2 Project Road)

- **Section 2: Asutuare – Aveyime Road (24.0km)**

2.4.5.1 Hydrological/Drainage Structures Findings

The existing drainage structures are structurally weak and of inadequate hydraulic capacities. Moreover, such drainage structures would have to be replaced. See **Table 9.0** for existing drainage structures on Section 2 project road.

Table 9.0 Hydrological/Drainage Structures Field Findings for Section 2 Project Road

Serial Number	Number Existing (No.)	Description	Comments
1	14	Pipe Culverts	Demolish and replace
2	1	U-Culvert	Demolish and Replace
3	17	Box Culverts	Demolish and replace

Source: KE&T Design Documents

2.4.5.2 Traffic and Geotechnical Investigations Results for Section 2 Project Road

The traffic studies and geotechnical investigations findings for Section 2 project road are disclosed below:

- ADT – 392
- AADT – 376
- An estimated Cumulative Equivalent Standard Axles (ESA) of 2,569,596 was obtained
- Sub-grade CBR obtained ranges from 9% to 32%
- A design CBR of 9% was used for pavement design

The same sources of construction materials as listed in Table 4.0 will also apply to the Section 2 project road.

2.4.5.3 Bridge Site Studies, Findings and Recommendations for Section 2 Project Road

The bridge sites field studies findings and recommendations for allowable bearing capacity and depths of foundations are given below with the respective chainages.

- Allowable bearing capacity and depths of foundation are;

  - ❖ Bridge at CH. 0+575; 200kPa at depth 3.0m
  - ❖ Bridge at CH. 5+875; 200kPa at depth 3.5m

2.4.5.4 Detailed Geometric Design for Section 2 Project Road

The detailed geometric design for Section 2 project road is shown in **Table 10.0.**

Table 10.0 Detailed Geometric Design for Section 2 Project Road

Design Parameters	Roads Classification	Design Speed	Minimum Radius (m)	Minimum Arc Length (m)	Minimum Curve (m)	Minimum K Value (Crest)	Minimum K Value (Sag)
-	Inter-Regional Road	80km/h	-	-	-	-	-
Horizontal Design	Inter-Regional Road	80km/h	424.413	140.0	-	-	-
Vertical Alignment	Inter-Regional Road	80km/h	-	-	70	30	18

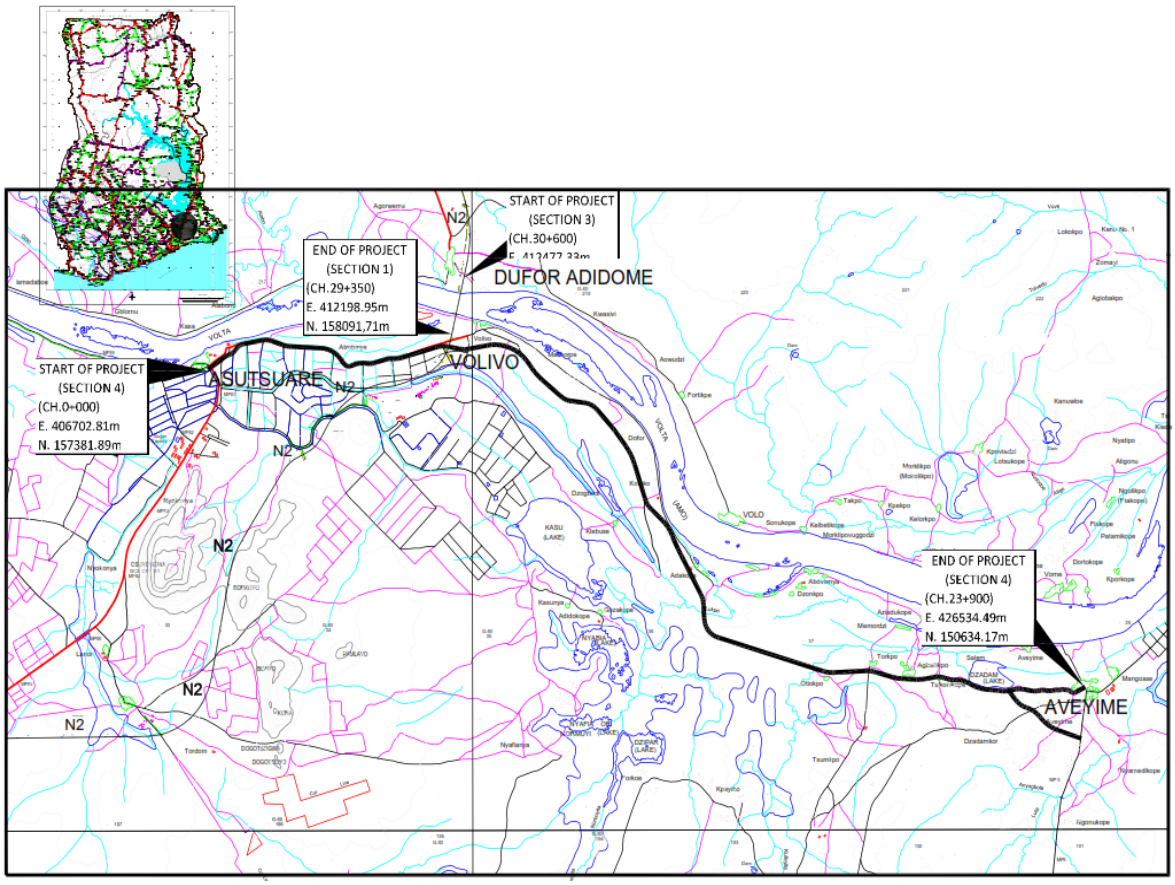


Figure 20 Asutuare – Aveyime Road (Section 2 Project Road)

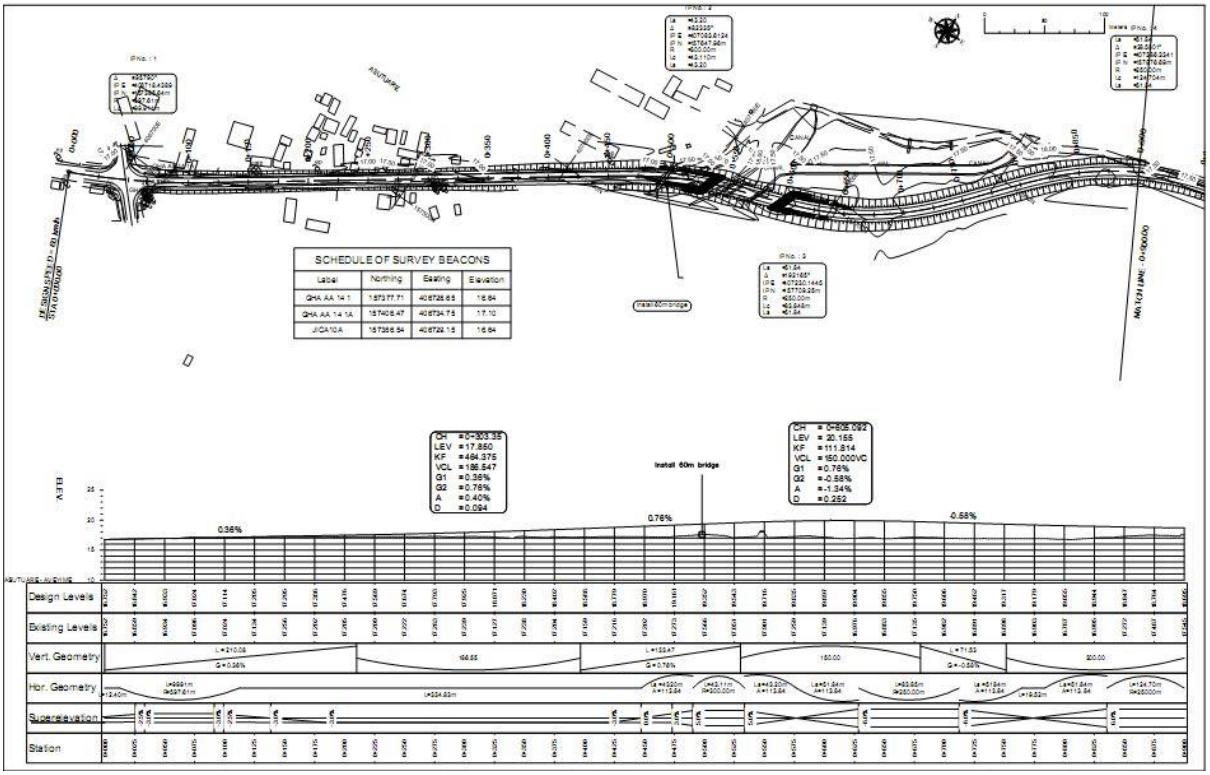
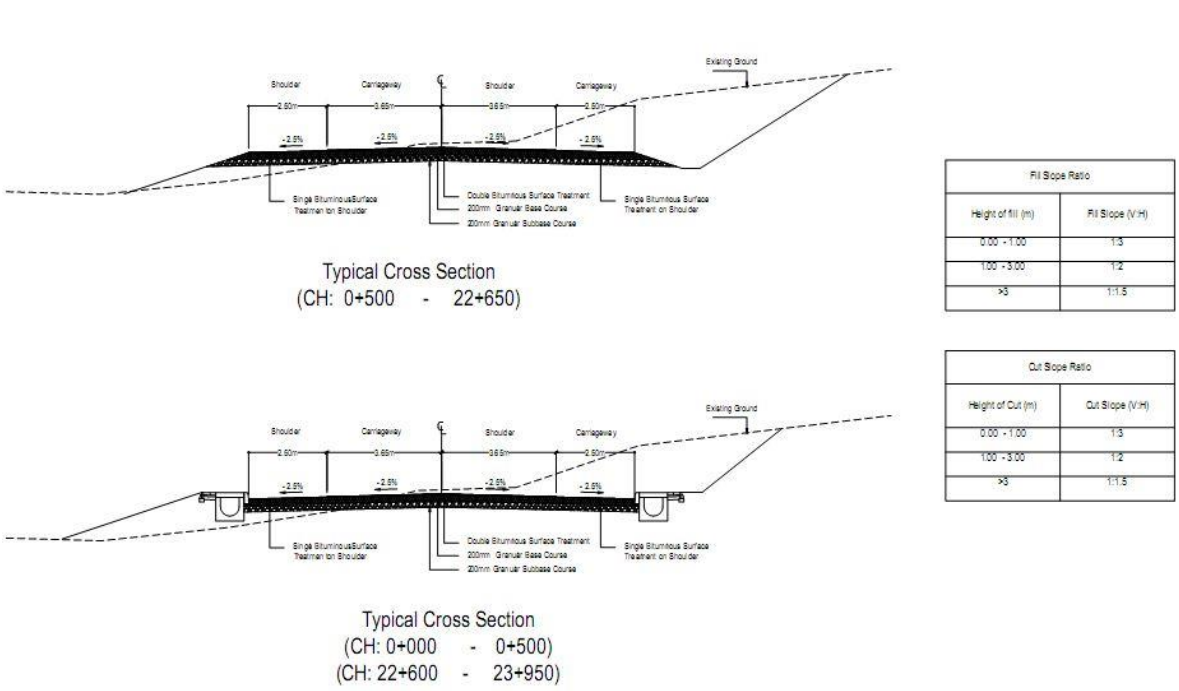


Figure 21 Sample Plan and Profile of Asutuare – Aveyime Road (Section 2 Project Road)



Fill Slope Ratio	
Height of fill (m)	Fill Slope (V:H)
0.00 - 1.00	1:3
1.00 - 3.00	1:2
>3	1:1.5

Cut Slope Ratio	
Height of Cut (m)	Cut Slope (V:H)
0.00 - 1.00	1:3
1.00 - 3.00	1:2
>3	1:1.5

Figure 22 Typical Cross Section of Asutuare – Aveyime Road (Section 2 Project Road)

2.4.5.5 Final Pavement Design for Section 2 Project Road

The final pavement design for Asutuare – Aveyime Road (Section 2 Project Road) is depicted as follows:

- Double Surface Dressing:
    - ❖ 200mm Granular Road Base
    - ❖ 200mm Granular Sub-base

2.4.5.6 Final Drainage Design for Section 2 Project Road

The final drainage design depicts the following:

- 3 No. Box Culverts
- 30 No. Pipe Culverts

2.4.5.7 Final Bridges Design for Section 2 Project Road

The final bridges design depicts the following:

- 25m span at CH. 0+625 over the irrigation canal
- 15m span at CH. 0+800 over the irrigation canal

2.4.5.8 Final Cost Estimate for Section 2 Project Road

The cost estimate for the Asutuare – Aveyime Road (Section 2 Project Road) is
USD 42,307,108.42

2.5 Project Activities Description

The project activities to be undertaken have the over-riding consideration that there will be avoidance or preservation of environmentally sensitive areas and limitation of settlement structures demolition. In addition, there will be the minimization of the destruction of trees, crops and arable farmlands, where applicable. And the project activities phasing for consideration are: pre-construction, construction and post-construction (decommissioning, operation and maintenance) phases.

2.5.1 Pre-Construction Phase Activities

The following pre-construction phase activities are required for the project: (i) feasibility study (ii) project roads identification and location (iii) project roads survey (iv) identification of site offices and site camps (v) acquisition of RoW (vi) consultations (vii) materials mobilization (viii) HIV/AIDS, Ebola and Cholera Awareness Training (ix) road safety awareness education (x) Environmental Protection Training.

Feasibility Study: This phase of the project cycle involves project planning and design, through conceptualization, feasibility survey and preparation of feasibility report. Various options consideration and recommendation are highlighted including the preferable option for the project.

Project Roads Identification and Location: The project roads identification and location were established from review of existing mapping. And field inspections were undertaken to confirm and clarify identified project roads and their exact locations.

Project Roads Survey: This activity was carried out by survey teams contracted by K E & T Consult Limited to carry out the survey of project roads, establish land profiles, limit of RoW and limit of construction and select the best alignments from several different options taking several factors into consideration. Some of the factors which were considered included, overall carriageway distances and the avoidance of the potential destruction of settlement structures (where applicable) and other environmentally and socially sensitive areas.

Identification of Site Offices and Site Camps: Principal site offices and camps will be selected with approval by the Site Engineer. This will also be done in direct consultation with the Metropolitan/District Assemblies and project community residents. Generally, the sites selection will involve fairly-flat terrain with sparse population densities and devoid of intense traffic and commercial activities.

Acquisition of RoW (Right-of-Way): Based on the issuance of an environmental permit from EPA Ghana, GHA will go ahead and acquire the RoW in compliance with all laws, regulations, operational directives and guidelines. Basically, the mode of assets valuation will take this dimension. Prior to the construction of the project roads, GHA and Land Valuation Division (LVD) will undertake a survey of all areas of land take, which includes a valuation of settlement properties, business structures, farmland, trees and crops in the RoW, that will have to be compensated. The valuation processes are discussed under compensation scheme.

Consultations: In the courses of the scoping exercise, some traditional authorities' representatives, project community residents, opinion leaders, metropolitan/district assembly's officials and regulatory agencies staff were consulted. This was to enable the survey team gain access to the proposed project roads, since the survey crew had to clear vegetation cover, trees and crops to make way for the survey program.

Materials Mobilization: The haulage of large quantities of construction materials-fine and aggregates-including cement by road to the project sites will take place. There will also be the transportation of heavy construction equipment and machinery to the project sites, under materials, machinery and equipment mobilization work program.

HIV/AIDS, Ebola and Cholera Awareness Training: HIV/AIDS, Ebola and Cholera Awareness Creation and Training Program will be organized for project communities and construction labor units. Moreover, sexually transmitted diseases awareness will be organized along- side the HIV/AIDS, Ebola and Cholera Awareness creation. The program will help explain the pandemic to the workers and the project community residents. The program is to make people aware that AIDS/Ebola and Cholera are real. Condoms and other accessories will be provided in the project catchment zones. There will also be the need to provide condoms at accessible points at the camp for the sexually active ones (ages 20-49) to use when the need arises. People will be encouraged to go for voluntary counseling and test at nearby hospitals or health centers.

Road Safety Awareness Education: Road Safety awareness Campaign through education will be instituted for project communities and construction crew to curb the likelihood of road accidents associated with project implementation. In collaboration with the National Road Safety Campaign of the Ministry of Roads

and Highways and the Traffic Police Unit, this activity will review the approach and methodology for the road safety awareness campaign and monitor the effectiveness of proposed mitigation measures. And the target groups will also include school children, street vendors and vehicle operators.

Environmental Protection Training: Environmental Protection Training will be organized for Contractors and other stakeholders. This activity will assist contractors to ensure environmental and social protection measures are adopted to instill good environmental and social management and monitoring practices during construction. Also, the training program will help protect, restore and enhance quality of the environment due to project implementation.

2.5.2 Construction Phase Activities

The following construction phase activities are required for the project: (i) excavations for drainage works (ii) excavations for Volta River suspension bridge anchorages (anchor blocks) foundations (iii) drainage works improvement for flood prone or low-lying areas (iv) construction of the Volta River suspension bridge structure (v) construction of roads protection structures (vi) improvements of sections of access roads leading into selected project roads (vii) installation of road signs and markings and relevant traffic control devices (viii) construction and/or treatment and sealing of shoulders or pavement works improvements (ix) construction and/or improvement of roads geometric features (x) construction and/or upgrading the existing project roads to asphaltic surface.

Excavations for Drainage Works: Information on drainage positions from design drawings will lead to excavation works for drains, culverts and storm channels. The drainage works will also lead to the casting of concrete or use of pre-cast concrete products such as U-drains, pipe culverts, box-culverts, etc., where applicable.

Excavations for Volta River Suspension Bridge Anchorages Foundation: The exact positions of the Volta River suspension bridge foundations will be derived from engineering design drawings. Such positions will lead to excavation works to hold anchorages foundations for reinforced concrete seat anchor blocks.

Drainage Works Improvement for Flood Prone or Low-Lying Areas: Flood-prone or low-lying sections of the project catchment zones will be improved through the installation of drainage channels or culverts to drain storm run-off. Such drainage works will involve the use of pre-cast concrete drain products or fresh casting of concrete batch in wooden or metallic molds.

Construction of Volta River Suspension Bridge Structure: The suspension bridge structure over the Volta River will be built of the following basic structural components: **anchorages** (massive concrete blocks which anchor main cables and act as end products of the suspension bridge); **main towers** (intermediate vertical structures which support main cables and transfer bridge loads to foundations); **main cables** (a group of parallel-wire bundled cables which support stiffening girders/trusses by hanger ropes and transfer loads to towers); **stiffening girders/trusses** (longitudinal structures which support and distribute moving vehicle loads, act as chords for the lateral system and secure the aerodynamic stability of the structure).

Construction of Roads Protection Structures: Roads protection structures will be erected at sections with embankments or approach roads to suspension bridge structure. Such structures will take the form of stone pitching, dwarf walls or hydro-seeded surfaces. These structures serve as erosion protection schemes to aid preservation of embankment or landslide zones.

Improvement of Sections of Access Roads Leading into Selected Project Roads: Access roads leading to selected project roads will be improved of their geometric features to blend with the proposed project roads. Where applicable, access culverts will be erected to serve as drainage channels to prevent erosion of the project roads foundation.

Installation of Road Signs and Markings and Relevant Traffic Control Devices: To minimize traffic confusion and delays, road signs and markings will be installed at the appropriate sections of the project roads. Relevant traffic control devices like signalization will be provided, including traffic management facilities like walkways, crossing and public bus stops or laybys. These devices will aid free flow of vehicles.

Construction and/or Treatment and Sealing of Shoulders or Pavement Works Improvement: Pavement improvement and/or construction will be undertaken at pavement sections or shoulders with residual strength and conditions at the end of their design life. These works involve strengthening and/or widening. Where necessary, construction and/or treatment and sealing of shoulders will be carried out.

Construction and/or Improvement of Roads Geometric Features: The geometric features of project roads, where feasible, will be constructed and/or improved to meet current design standards. Some of the geometric features include a new carriageway suspension bridge over the Volta River at Volivo to improve the flow of traffic at that corridor and connect Dufor Adidome – Asikuma Junction Road (Section 3 Project Road).

Construction and/or Upgrading the Existing Project Roads to Bituminous Surface: Construction and/or surface improvement works of the project roads will lead to double bituminous surfacing of the selected project roads. Such surfacing scheme will prolong the design life of those project roads.

2.5.3 Post – Construction Phase Activities

The following post-construction phase (decommissioning, operation and maintenance) activities are required for the project: (i) decommissioning of site offices and lay-down areas (ii) drainage maintenance (iii) suspension bridge inspection and maintenance programs (iv) surface maintenance on paved roads (iv) road side maintenance (v) road side furniture maintenance.

Decommissioning of Site Offices and Lay-Down Areas: (i) lay down areas materials, equipment and machinery decommissioning (ii) construction sites materials, equipment and machinery decommissioning (iii) decommissioned waste materials collections, stocking, haulage and transportation for reuse or disposal at approved locations (iv) sites restoration schemes involving re-vegetation and reclamation of areas. During decommissioning phase, all work areas and offices and workshops/garages and other temporary installations will be cleaned up and the site restored. These include removal or reuse of temporary buildings, materials, wood, refuse, surplus materials, embankments or another material that is not in the area before construction of works. All effected natural drainage systems will be restored, and excavated materials will be used to fill excavated areas. The damaged areas will be restored to make it compatible with future use.

Drainage Maintenance: The maintenance scheme for drainage systems will involve the following: ditch clearing by manual labor, ditch clearing by mechanical plant, re-excavation of damaged ditches to install high-capacity channels for storm run-offs, clearing and minor crack repair on drainage structures and erosion and scour repairs.

Suspension Bridge Inspection and Maintenance Program: The suspension bridge inspection program must be undertaken thoroughly as necessary to clearly establish its condition, inspected at the appropriate interval or frequency to insure its continued safe operation. Bridge Condition Assessment Investigations to be performed will include: initial inspections, routine inspections, fracture critical inspections, special inspections, in-depth inspections and damage inspections. However, the suspension bridge maintenance program will cover four (4) schemes: preventive maintenance, minor repairs, deferred maintenance and major repairs depending on the condition of the structures in an inventory.

Surface Maintenance on Paved Roads: Paved roads surface maintenance works will involve the following: pothole patching on bituminous surface dressing, pothole patching by pre-mix, pothole patching by hot-mixed asphaltic concrete, repair of depressions, ruts, shoving and corrugations, edge failure repairs on bituminous surface dressed roads and asphaltic concrete roads, crack sealing and resurfacing and re-sealing.

Road Side Maintenance: The roadside maintenance schedule will encompass the following scheme: grass cutting by manual labor, grass cutting by mechanical plant, tree/bamboo clearing and bush clearing.

Road Side Furniture Maintenance: The maintenance scheme of road side furniture will incorporate the following: road sign cleaning and painting, repair and replacement of traffic signs, repair and replacement of guide posts and guard rails and road line marking.

2.6 Project Baseline Environmental and Social Conditions

Physical Environment

2.6.1 Climate

Asuogyaman District: The district lies within the Dry Equatorial Climate Zone which experience substantial amount of precipitation. It exhibits double maxima rainy season which reaches its peak period in May–July and the minor season occurs in the period of September-November. Annual rainfall usually starts in April with the peak in June and ends in November. The dry season starts in November-December and ends in March. The annual rainfall is between 67mm and 1130mm. Temperatures are warm throughout the year with maximum monthly mean of 37.2^{o}C and a minimum of 21^{o}C. Relative humidity is generally high ranging from the highest of 98% in June to 31% in January.

Dangbe West District: The district lies in the Coastal Savannah Zone with double maxima rainy season pattern. The rainfall averages between 762.5mm and 1220mm. The first rainy season is in April and ends in August, while the second rainy season begins in September and ends in November. The coldest months are between July and August. In November, the mean temperature is 30°C but in March it is about 40°C. The relative humidity is 65% to 98% in the day and night respectively.

North Tongu District: The average annual rainfall varies from 900 mm to 1100 mm with more than 50% of it falling in the major season of April through July. The mean temperature is about 27^{o}C. The maximum and minimum temperatures vary from 22^{o}C to 33^{o}C respectively.

Greenhouse Gas Emissions: Climate is an important consideration, not only for the impacts it may have on pollutants in the air, but also for the impact of human activity on the climate. Greenhouse gases

(GHGs) such as water vapor, carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (NO_2), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride are gases that trap radiation and warm the planet's surface. Too many of these gases may overly heat the atmosphere, in effect, changing the climate. GHA has proposed an Action Plan for Climate protection to confront the issue and deal with the possible impacts.

In addition to dust and exhaust from construction, this roads project will result in increase in GHGs emissions. The GHGs that will result from the roads program have not been estimated, due to lack of information from the construction of, the energy demands of, and the transportation demands of this Proposal over the life of the drainage structures and pavements. Besides the GHGs generated from the construction and use of the new side drains, bridges and the new pavements, there will be emissions from vehicular traffic flow that will result from the increased capacity of the terminal building and runway ends extension. The project roads will be able to handle the increase in vehicular movements, passenger numbers and the increase volume resulting from more motor vehicles and therefore more emissions.

2.6.2 Seismicity, Seismic Activities and Geo-hazards: Ghana is far from the world's major earthquake zones but has been known to be seismically active for centuries. Earthquakes of magnitude greater than 6.0 have been recorded; however, current seismic activities have been confined to local tremors of 4.8 or less on the Richter Scale. The earthquakes have mostly occurred west of Accra in the area where the Coastal boundary fault and Akwapim fault zone meet. It is important that all foundation structures adhere to the "Code for Seismic design for Concrete Structures" (Nov. 1990) as well as the National Building Regulations, 1996, LI 1630. The IEC standard requires a site estimate of the peak ground acceleration (PGA) with a recurrence period of 475 years for the site area. This recurrence level is equivalent to an annual risk of exceedance of 0.2%. There is no explicit IEC limit for PGA, hence the general hazard levels have been adopted in "Low hazard" results in OK, "Moderate hazard" in Caution, and "High" and "Very high hazard" results in Critical, emphasizing the need for further and detailed investigation of seismic loads. Environmental risks like earthquakes and landslides are not considered as major risks and have not been captured. A report by Amponsah (2004) mentions that in 1862, 1906 and 1939 important earthquakes occurred, reaching up to level 6.5 on the Richter scale, but since then, the most important ones only reached rather moderate levels of 4.8 on the Richter scale.

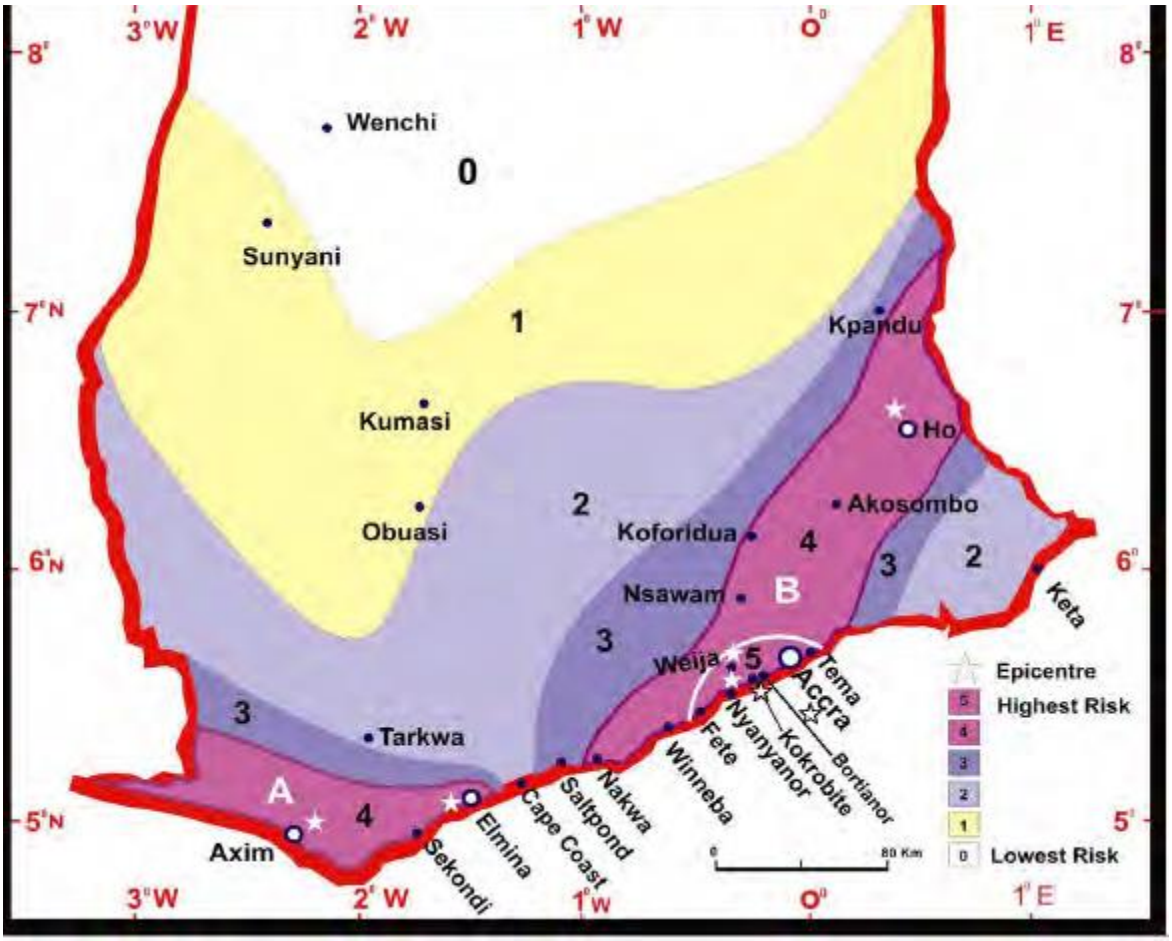


Fig 23.0 Earthquake Risk Zones in Southern Ghana

The project zone is a seismically active area. As a result, reference to seismic activities and geo-hazards, the site and surrounding area is located within a region with highest risk factor of intensity. That is, the project zone does lie within the very heart of seismic zone activities, according to Geo-Hazards Records. The area is considered as a region with highest potential of earthquakes occurrences. Moreover, historically, there have been two earthquakes occurrence over the sites and surrounding areas.

The bridge site of the project zone is located near an active fault which experienced big earthquakes in 1862 and 1939 of about 6.5 and 6.4 magnitude respectively. Given the level of non-occurrence of historic seismic activities in the bridge site of the project location since 1939, the risk is still considered significance. A technical note can recommend that a risk/cost analysis is undertaken if it is deemed to be a concern for the proposed project. If a seismic event causes an earthquake large enough to hit the bridge site a significant warning period should be provided. It is therefore recommended within the Emergency Response Plan specific measures are outlined to manage the unlikely event of an earthquake affecting the bridge site of the project enclave. Within this, a framework should be to ensure that the following measures are instituted: (i) a warning system is developed on the proposed bridge site and all on site are aware of its presence and purpose (ii) in the event of an alarm evacuation measures should be instituted as far as possible (iii) Volivo and Dufor Adidome residents and visitors are evacuated from the bridge site and all buildings.

2.6.3 Topography

Asuogyaman District: The district's relief characteristics are generally undulating with steep slopes in some parts. The district is interspersed with five highlands, which are rocky in nature. On average the highest of the peaks in the district ranges from 70 to 800 m above sea level.

Dangbe West District: The district forms part of the central portions of the Accra plains. The relief of the project zone is generally gentle and undulating, a low plain with height not exceeding 70m. The plains are punctuated in isolated areas by a few prominent inselbergs, isolated hills, outliers and knolls scattered erratically over the area.

North Tongu District: The topography is gentle, ranging from near sea level to about 18m above sea level, with slopes less than 5%. The areas near the Volta River are at higher elevation, falling gradually backwards and rising again into the Adaklu Hills.

2.6.4 Geology and Soils

Asuogyaman District: The project area is underlain by the rocks of the Dahomeyan series of Precambrian age, which form the basement complex of Ghana. They consist of mainly foliated biotite granite gneisis, granite augengnesis and gneiss – Schist with occasional thin beds of quartzite. The major soil groups in the corridor are mainly coastal savanna, ochrosols, lateritic sandy soils, tropical black clay or Akuse soils, and coastal sands. Low-lying areas along the Volta Lake have Savannah Greisol and Aluviosols soil types. Because of their structure, these soils are liable to temporary flooding in times of high-water levels. Their nutrient status is moderate but to ensure sustained yield of crops they require the use of fertilizer.

Dangme West District: The geological structure of the district is made up of ancient igneous rocks. These rocks, of Dahomeyan gneiss and schists, comprise large inselbergs (isolated rocky hills) in the north and central parts of areas outside the project zone. The soils underlying the project zone are black and clayey, sandy and poorly drained.

North Tongu District: The geology comprises of few inselbergs, namely Avakpe, Asiekpe and Kluma Hills are composed of granite rocks. The Todze Hill located near New Bakpa is composed of mainly gravel. Soils in the district are dominantly medium to moderately coarse textured alluvial soils along the Volta River. Heavier clay soil, leading to poor surface and sub-surface drainage, make road development very difficult. Moreover, soils are difficult to cultivate because they have low water holding capacity. Areas around Adidome, Anfoe, Kpedzeglo, Mafi Kumase, Sasekpe and Bakpa Avedo consist of moderately coarse or sandy loams wich drain easily and are suitable for agricultural purposes.

2.6.5 Hydrography and Water Resources

Asuogyaman District: The critical area of the Volta gorge is situated in this district. The Volta Lake flows through definite channels within the gorge area but spread upstream, after Gyakiti and Boso into the Volta Lake. The Volta Lake is heavily braided at Atimpoku as it flows over the low-lying areas of the district and begins to meander its way into the sea at Ada. The flow of the Volta River through the undulating landscape of the district creates an extensive lakefront good for tourism development.

Dangme West District: The very seasonal nature of most of the streams caused by high temperatures and equally high evaporation levels have encourage the construction of artificial dams and ponds. These water holding systems of varying sizes are used for irrigation and for watering of livestock.

North Tongu District: The district is drained by Alabo, Kolo, Aklakpa, Gblor and Nyifla streams and their numerous tributaries into the Volta River, running north-south through the district. The Todze and its western tributaries drain the eastern part of the district into the Avu Lagoon. During the rainy season, these streams overflow their banks, causing damage to roads and farms. Inland creeks include Kebena, Dear, Dove, Aklamadaw, Amidoe and Akplordodi. Several ponds and dugouts have been created with major ones located at Atiteti, Adudomu, Mafi Kumase, Adidokpavu and Teleafenu.

2.6.6 Air Quality, Dust and Odor

Asuogyaman, Dangme West and North Tongu Districts: The vehicular traffic generated air pollution poses an intermittent threat to create severe pollution in the project corridor because of the absence of trees cape or trees canopy alignment within the road's corridor of the project landscape. Generally, the air ambient quality at the project sites will be punctuated by vehicular exhaust fumes, total suspended particulate and inhalable particulate matter (PM_{10}).

Moreover, the intensity of such emissions will increase with the increasing number of vehicular traffic movement during peak rush hours (6am and 8am in the mornings; 4pm and 6pm in the evenings) on market days. However, periods of reduced vehicular movements will portray lessened vehicular traffic activities hence minimal number of vehicular traffic movement translates into less exhaust fumes delivery. At such times, the air quality is slightly degraded. But these processes of deterioration are all reversible, resulting in the re-adjustment of air quality to acceptable national standards (field sampling of air quality analysis would have to be carried out and the results will be disclosed for EPA Ghana permitting purposes).

Ghana regulates air pollutant emissions from industrial sources and has established ambient air quality guidelines. Ghana's guidelines standards are, for the most part, as stringent as the World Bank Guidelines for ambient air quality for industrial areas, and more stringent for residential areas.

2.6.7 Noise Levels

Asuogyaman, Dangme West and North Tongu Districts: The increase number of vehicular traffic at project zone during peak rush hours (6am to 8am in the morning; 4pm to 6pm in the evening) on market days lead to a higher frequency in automobile engine noise pollution and auditory nuisance. Greater intensity of such noise and auditing distortions will increase during rush hour continuous idling of automobile or vehicular engines on market days within marketing centers. But less reduced occurrences in vehicular movement during non-peak rush hours, will originate slightly induced disturbances from noise pollution during non-market days within marketing centers.

Biological/Ecological Environment

2.6.8 Flora Species

Asuogyaman District: Predominant vegetation type is of the short grass savannah interspersed with shrub and short trees, a characteristic of the Sub-Sahelian type. The vegetation is dense along the Volta River and along the stream basins.

Dangme West District: A large portion of the flora community remains dry for most parts of the year, except for the short rainy season. Along the Dodowa River basin (outside the project roads corridor), higher vegetation cover ranges from thickets to light forest which form vegetative colony around the

river basin. But the dry season depreciate the quality of this vegetation cover within the river basin since the Dodowa River then dries up.

North Tongu District: The vegetation type is Tropical Savannah Grassland, which is dense along the Volta River and stream basins. The vegetation consists of mangrove, oil palms, baobab, silk cotton, acacia, etc. Away from rivers/streams the vegetation is sparse, predominantly grassland, interspersed with neem trees and guinea grass, digitaria, decumbent and fan palms, which dot Mafi Kumase and Agohome-Avetakpo areas. Neem and other trees harvested for fuel and charcoal burning (provides revenue but destroy the vegetation cover with subsequent ecological problems). Major affected areas are Alabo, Mafi Kumase, Volo, Dorfor Aklakpa and Dedukope. Shrub and grassland areas which are suitable for cattle grazing make the district one of the largest cattle producing areas in the country. But uncontrolled grazing and frequent bushfires are gradually, reducing such areas into desert lands.

2.6.9 Wildlife Species

Asuogyaman District: Harvesting of trees for lime and charcoal production in the district including poaching activities have caused wildlife decimation. Wildlife such as antelopes, monkeys, hogs and others have fled for other reserves either close to or away from the project roads corridor to avoid poaching by humans. Partridges are however still common in the area.

Dangme West District: The fauna content home to the vegetation cover includes wildlife species such as antelopes, deer, grasscutter and rodents. The fauna species are hunted for protein food source to improve the nutritional value of the human population within the district.

North Tongu District: The Kolo and Akalakpa Reserves have been destroyed through trees harvesting for lime and charcoal production at Battor, Volo and Darfor. Wildlife poaching activities have reduced the numbers of elephants, antelopes, monkeys and hogs. But partridges are still common.

Wildlife Migration Routes: There are no clearly defined wild animal migration routes, but there is a strong presence of animal breeding outside and inside the project roads catchment zone. There is a consistent presence of commercial cattle keeping and goats and sheep for local consumption and breeding purposes.

2.6.10 Sacred Sites

Asuogyaman, Dangme West and North Tongu Districts: The proposed project roads lie outside three (3) notable, highly sensitive forest reserves. These forest reserves are Shai Hills Resource Reserve, Kalakpa Resource Reserve and Dodowa Forest Reserve. These protected natural biodiversity resources all lies outside the proposed project roads domain of influence. The Shai Hills Resource Reserve is well managed by Ghana Wildlife Division and attracts eco-tourists. However, due to limited access to the Kalakpa Resource Reserve, it has been left with minimal care. But the Dodowa Forest Reserve, because of its historical, cultural and heritage influence enjoys both local and international tourist patronage.

Human Environment

2.6.11 Demography and Settlement Pattern

Asuogyaman District: According to the 2010 Population and Housing Census, the district had a population of 98,046 persons of which 52.0% (51,016) were females and 48.0% (47,030) were males. Of the total

population, 71% lives in rural areas while 30% lives in the urban centers. The population density is about 65.1 persons per square kilometer.

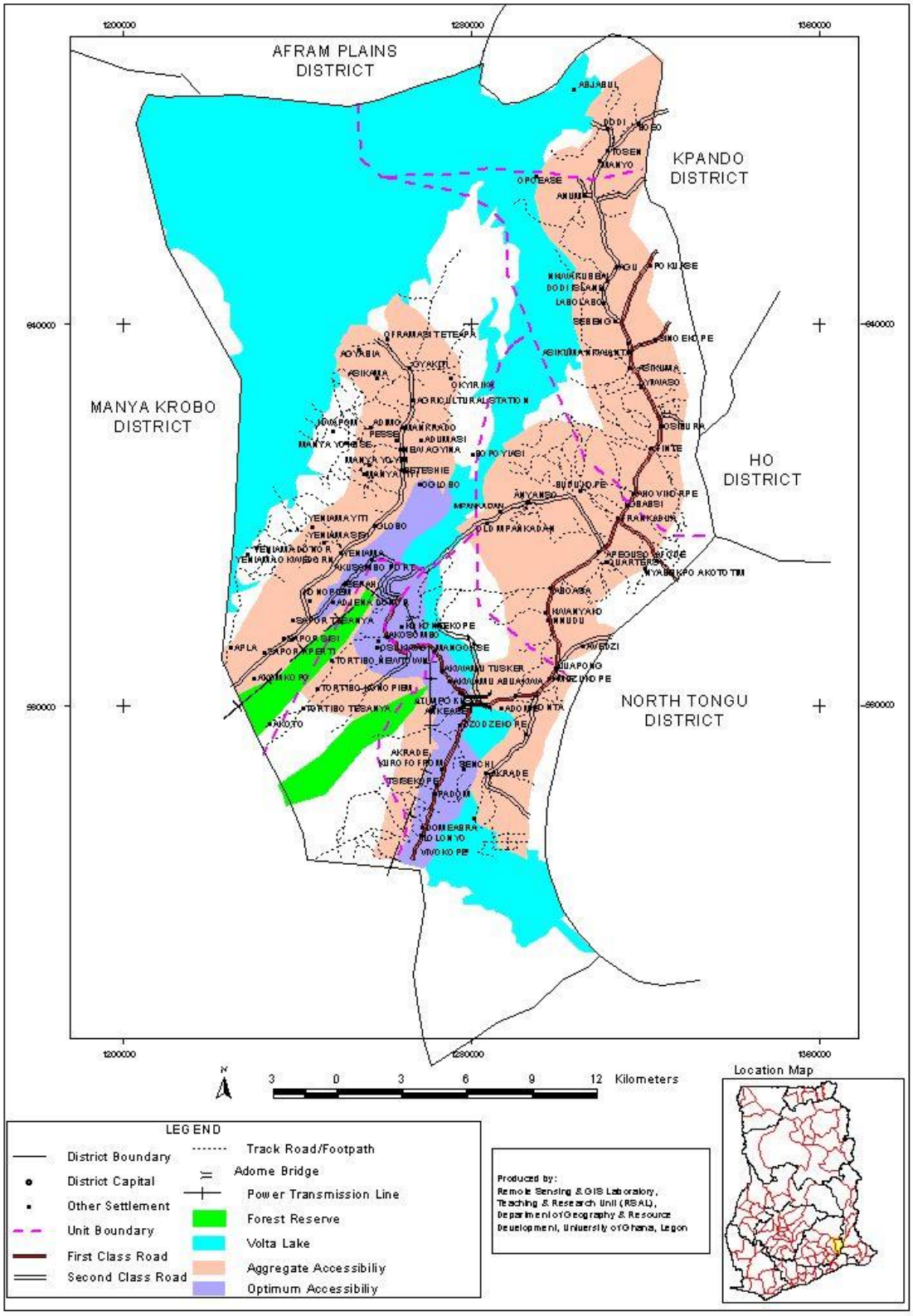
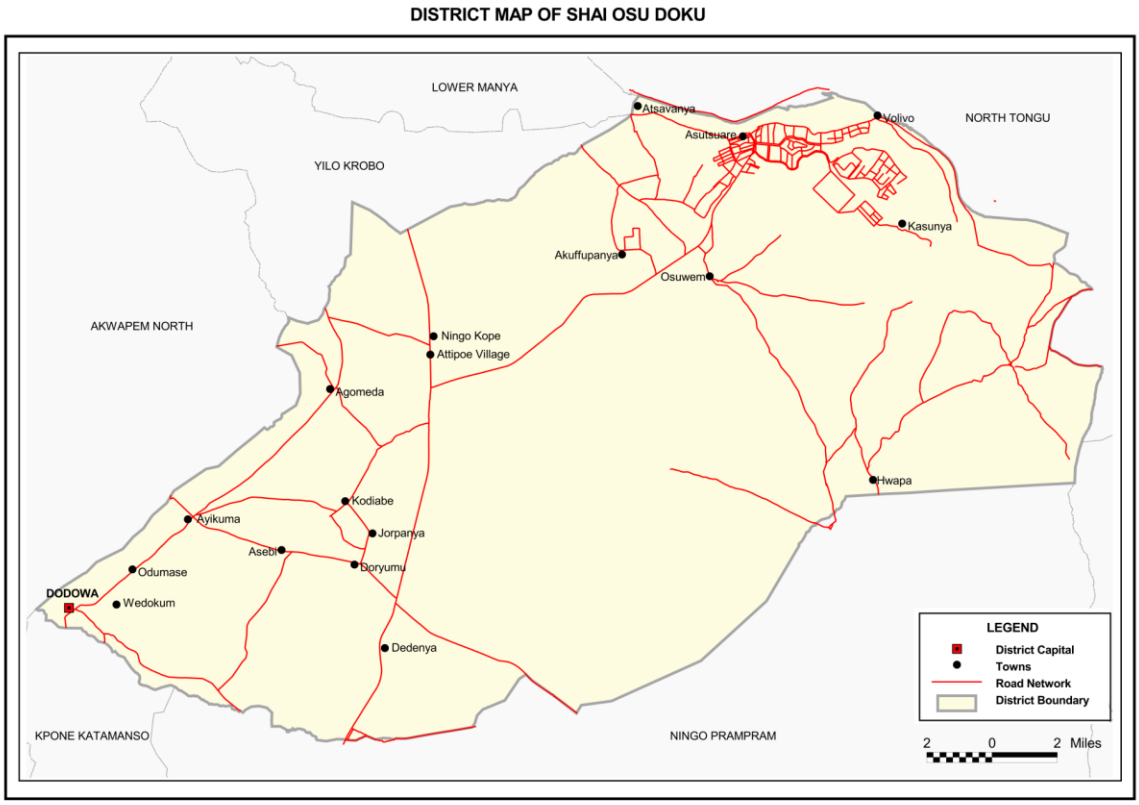
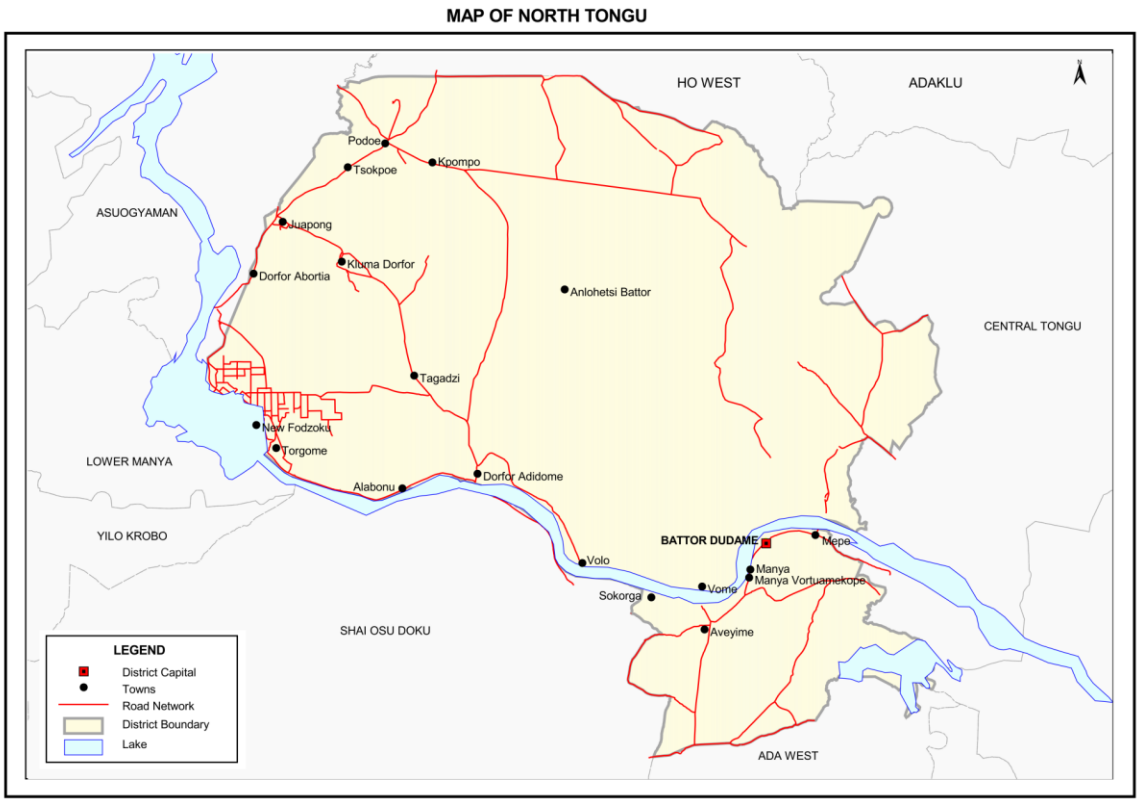

AFRAM PLAINS DISTRICT
KPANDO DISTRICT
MANYA KROBO DISTRICT
HO DISTRICT
NORTH TONGU DISTRICT
1200000
1280000
1360000
640000
580000
3 0 3 6 9 12 Kilometers
Location Map
LEGEND
District Boundary
District Capital
Other Settlement
Unit Boundary
First Class Road
Second Class Road
Track Road/Footpath
Adome Bridge
Power Transmission Line
Forest Reserve
Volta Lake
Aggregate Accessibiliy
Optimum Accessibiliy
Produced by:
Remote Sensing & GIS Laboratory,
Teaching & Research Unit (RSAL),
Department of Geography & Resource
Development, University of Ghana, Legon

Figure 24: Asuogyaman District Map

Dangme West District: In 2010, the district had a population of 20,330 persons (2010 Population and Housing Census). Males made up of 48.2% (9,799) and females 51.8% (10,531). The district is mainly rural with about 32% of its population in urban areas. The settlement pattern is about 11.6 persons per square kilometers. Some sections of the project roads pass through the newly created Shai-Osu Duku District.



North Tongu District: The total population of the district in 2010 was 82,152 people (2010 Population and Housing Census). Females made up 51.5% (42,308) and males 48.5% (39,844). The population density of the district is about 128.4 persons per square kilometers. The population is mainly rural, with 94% living in rural areas compared with 6% living in the urban centers.



2.6.12 Culture, Ethnicity and Religion

Asuogyaman District: The district has three (3) traditional councils of Boso, Anum and Akwamu. It has a heterogeneous cultural and ethnicity structure. As at 2010, the ethnic balance was as follows: Akwamus (80% of population), Guans, Ewes, Krobos, Dangme and peoples of Northern, Upper East and Upper West (combined, constitutes 20% of the population). Religious beliefs are profiled in the following categorization: Christians (89.1%), Moslem (3.7%), Traditional (2.4%) and No Religion (4.8%).

Dangme West District: The seat of the traditional council is at Dodowa. The district is dominated by Dangbes (75% of the population), with Ewes and Akans, Gas, Krobos Guans and peoples of Northern, Upper East and West forming the main minority ethnic groups (combined makes up 25% of the population) as at 2010. Christians (74.7%), Islam (4%), and Traditional Religion (21.3%) describe the religious beliefs of the district faith profile.

North Tongu District: Juapong is the seat of the traditional council. The ethnicity profile of the district mirrors most of the other districts within the project roads corridor, with Ewes (85% of the population), Guans, Akans, Krobos, Dangbes, Northern, Upper West and East making up the minority group (combined, captures 15% of the population). Religious beliefs depict the following statistics: Christians (60%), Moslem (3.9%), Traditional Religion (36.1%).

2.6.13 Economy and Employment

Asuogyaman District: Agriculture is the major economic activity for employment and rural income generation. About 75% of the working population is engaged in this sector, followed by commence (6%),

service (4%) and industry (15%). About 69 percent of the population aged 15 years and older is economically active while 31.2 percent are economically not active. Of the economically active population, 93.0 percent are employed while 7.0 percent are unemployed. The main reason for not being economically active for both sexes is full time education (64.3% of males and 43.1% of females). Of the employed population, majority are engaged as skilled agricultural, forestry and fishery workers (36.4%) and service and sales (21.6%). Agricultural, forestry and fisheries (42.3%) is the main occupation for males while it is service and sales (33.1%) for females.

About 63.2 percent of the population 15 years and older are self-employed without employees and 24.2 are employees. A higher proportion of females (74.2%) are more likely to be self-employed without workers than their male (50.9%) counterparts. The informal private sector is the largest employer of persons in the district (78.3%), followed by the private formal sector (10.8%) and public (government) sector (8.3%).

Dangme West District: The population of the active labor force engaged in various sectors of the local economy is given as follows: agriculture (65%); commence (25%); service (3%) and industry (7%). The District data shows that 69.2 percent of the population is economically active, with 72.8 percent representing males and 66.0 percent representing females. Again, 93.3 percent of the economically active population is employed with males (94.4%) and females (92.3%). In addition, 6.7 percent of the economically active population is unemployed with males representing 5.6 percent and females7.7 percent. Additionally, majority of the unemployed population are seeking work for the first time (55.3%).

Agriculture, forestry and fishing industry engages 46.4 percent of the employed population 15 years and older in the district. The agricultural industry is followed by wholesale and retail, and manufacturing industries which employ 15.2 percent and 12.7 percent respectively. With respect to employment status, Self-employed without employees has 59.6 percent and with employees' 24.1 percent. The private In-formal sector employs most of the employed with 80.6 percent. The government sector engages 8.5 percent and the Private Formal sector 10 percent.

North Tongu District: Agriculture employs about 70% of the active labor force followed by commence (20%), service (9%) and industry (1%). About 66.3 percent of persons aged 15 years and older are economically active while the economically not active constitute 33.7 percent. The percentage of unemployed in the District is 4.2 percent and the employed constitute 95.8 percent of the economically active population. The District also has 53.3 percent of its population 15 years and older in full time education and therefore not economically active.

The North Tongu District, being an agrarian economy, has more than half (57.2%) of the employed population engaged in skilled agricultural, forestry and fishery whilst 15.3 percent are involved in service and sales. With respect to employment status and sector of employment the 2010 census result indicates that 71.9 percent of the employed in the District are self-employed without employees, 10.5 percent are Employees and 11.4 are contributing family workers. The private informal sector is the largest employer in the District (90.8%) and the Public sector 4.8 percent.

2.6.14 Agriculture

Asuogyaman District: Agriculture is the major economic activity in terms of employment and rural income generation in the District. About 75 per cent of the working population is engaged in this sector which constitutes the main source of household income in the district. There are three (3) prominent types of

farming activities in the District. These are livestock farming, food cropping and fishing. The most predominant of these is crop cropping with more than 78 per cent of the farmers in the District taking to this type. The major food Crops produced in the District is maize, cassava, plantain, yam and vegetable. The main farming areas are Tortibo, Domeabra, Mpakadan, Frankadua, Fintey, Gyakiti, Ankyease and Survey line. There is large track of land for commercial farming and other Agro-Business in these areas
The main types of livestock reared in the District are cattle, goats, sheep, poultry and pigs. Also, there are two kraals at Asikuma and Nkwakaben. The main problems affecting farming in the district are low price paid for farmers produce, lack of funds, irregular rainfall, pest and diseases infestation.

Fishing in the Volta Lake which constitutes an important segment of the agriculture sector is done in some communities along the 141km shoreline including parts of the Kpong headwaters. These communities include Dzidzokope, Atimpoku, Abume, Akosombo, Surveyline, Adomi, Dodi Asantekrom, Asikuma, Mpakadan and Senchi Ferry and old Akrade. Volta River Authority and Akosombo Textiles form the major industry employing a major proportion of the population. Major hotels and tourist sites (Volta Hotel, Senchi Royal Hotel, Akosombo Continental Hotel, Afrikiko River Front and Sajuna Beach Park) also contribute to the economy by attracting tourist from all parts of the world.

The service sector serves as the main source of employment for the urban populace, partly due to the presence of major roads; Accra-Akosombo; Accra-Ho and others, which pass through the urban areas where trading and other service activities are very brisk. **Food Security:** The major economic sectors and opportunities for private sector discussed in this chapter are the areas of agriculture which is the main stay of the District economy, manufacturing, quarrying and commerce. The informal small-scale businesses, marketing, finance and tourism were also discussed. **Farming Systems:** Agriculture is predominantly on small holder basis in the District. About 90% of the farm holdings are less than 3 acres (1.2 ha) although there are some large farms and plantations particularly for mango and banana. The main system of farming is traditional slash and burn, with the hoe and cutlass as the main farming tools. **Farming Activities:** There are four (4) prominent types of farming activities in the district: food cropping, cash cropping, livestock farming and aquaculture. **Food Cropping:** Seventy-eight per cent (78%) of the farming population is engaged in crop production. The major crops are maize, cassava, vegetables and yam. Large numbers of these farmers have small holdings. The main farming areas are Tortibo, Domeabra, Mpakadan, Frankadua, Gyakiti, Ankyease, South-Senchi, Survey line, Yeniama and Sapor. **Livestock:** The main types of livestock reared in the district are cattle, goats, sheep, pigs and poultry. Most of the livestock farming that goes on in the district is on subsistence levels. **Fishing:** Fishing in the Volta Lake which contributes as an important segment of the agricultural sector is done in some communities along the 141km shore line, including parts of the Kpong head waters. These communities include Dzidzorkope, Atimpoku, Akosombo, Survey Line, Small London, South- Senchi, and Dodi Asantekrom, Kudi Kope, Sedom. Total fish caught on the lake as at the first quarter of 2007 amounted to 434 tons. There are commercial and small-scale fish farms totaling about ninety in number. Most of these farms have engaged in cage culture. The commercial farms include West Africa Fish Ltd at Asikuma and Tropo Farms at Mpakadan producing table-size fish and Crystal Lake Fish Ltd at Dodi Asantekrom producing mainly fingerlings for supply to farmers. **Non-Traditional Agricultural Crops:** The main non-traditional agricultural crops cultivated in the district include banana, mango, pineapple and vegetables.

Dangme West District: Agriculture is the predominant source of the district economy. In the agriculture sector, about 90% of the total land area comprises arable land but only about 35% of this is currently under cultivation. About 75% of the active labor force is engaged in agricultural activities such as crop farming, fishing, livestock and forestry. Major crops cultivated are cassava, maize, rice, pepper and legumes. Horticulture crops such as mangoes, pineapple, cashew, water melon, cabbages, lettuce and cucumber are also produced. **Livestock:** About 75% of the arable land is mainly savannah grassland, which

is very suitable for livestock rearing. Currently, the district has the largest population of cattle in the Greater Accra Region. The Agortor settlement area has been identified as the main location for cattle production in the district. **Non-agriculture:** Non-agricultural activities encompass the following: wood processing; mining and quarrying; construction and building; vehicle repair and maintenance; charcoal production; salt mining and beekeeping.

North Tongu District: Agriculture is the leading sector in the District's economy. The sector is dominated by small scale unorganized farmers who depend mainly on simple labor-intensive production techniques. Though the Agricultural sector is the leading economic sector, it is characterized by low productivity resulting from the continuous usage of indigenous farm implements and adoption of indigenous farming practices. Another feature is the high level of post-harvest losses particularly in maize and vegetable production. **Fishing:** River fishing mostly in the Volta River has declined considerably due to the formation of the Volta Lake. The principal traditional fishing communities (Bakpa, Mafi, Mepe, Battor and Volo), which are close to the Volta, have had their economic base eroded. Many of the economically active population have been lost to areas along the Volta Lake in the Kete-Krachi, Nkwanta, Kpando, Atebubu, Gonja-East, Afram Plains and other districts. Most of the streams and ponds / creeks which used to contain lots of fish have been completely depleted due to the absence of the annual flooding from the Volta that stocks them with fish. **Livestock:**The livestock sector forms an integral part of the farming system. More than 30% of the farming families in the District keep some ruminants. The North Tongu District is one of the largest cattle producing areas in the country. Apart from the three major cattle ranches at Aveyime, Amelorkope and Adidokpavu, individual farmers keep Kraals all over the District.

2.6.15 Education Provision

Asuogyaman District: As at 2010, educational facilities in the district are as follows: 98 Primary Schools (68 Public and 30 Private); 49 JHS (36 Public and 13 Private) and 7 SHS (5 Public and 2 Private). About 36,711 persons in the district are attending school. Of those in school 88% are at the basic level (nursery, kindergarten, primary and JHS) and 8.8% at SHS level. Only 2.2% are at the tertiary level. About 2.5% males are benefiting from tertiary education as against 1.8% females.

Dangme West District: In 2010, of the population 11 years and older 70.7 percent are literate, with 45.9 percent being literate in English and Ghanaian language only. Also, 49.8 percent of those currently attending school are in primary school. Educational facilities in the district recorded in 2010 were these: Pre-school 132 (69 Public and 63 Private); Primary 131 (79 Public and 52 Private); JHS 71 (15 Public and 56 Private) and SHS 6(3 Public and 3 Private).

North Tongu District: Of the Districts population in 2010, 16,615 are 11 years and older and 74 percent are literate with more literate male (51.7%) than female (48.4%). The majority (70%) of the literate population (11years and older) are literate in English and Ghanaian language only. Also, of the 3 years and older currently in school, 49 percent are in primary school. There were 97 kindergarten, 95 primary, 61 JHS and 4 SHS educational infrastructure in 2010. Moreover, there was 1 special school for rehabilitation of mentally retarded and 1 farm institution at Adidome.

2.6.16 Health Care Delivery

Asuogyaman District: There are two (2) major hospitals in the district as at 2010. They are VRA Hospital and Asuogyaman District Hospital. The district has these medical facilities: six (6) clinics, two (2) private

hospitals and seven (7) functional CHPS centers. Health care service delivery is provided by 279 total staff strength, most of them are at the VRA Hospital. Specific HIV/AIDS prevalence information at the district level was not available for documentation in this ESIA. However, being a district within the Eastern Region the HIV/AIDS prevalence among pregnant women attending ANC clinic in 2009 was 4.2 (this was above the national average of 2.9).

Dangme West District: The number of health care facilities in the district in 2009 included the following: 1 (district hospital); 9 (CHPS centers); 3 (health centers); 2 (private clinics); 1 (private medical center); 2 (private maternity homes) and 2 (quasi-government institutions as clinics). The recorded cases of HIV/AIDS in the district in 2008 and 2009 were as follows: 2008 (231 cases) and 2009 (201 cases). In 2008, 231 positive cases consisting of 106 related cases from counseling and testing (CT) and 125 cases from Prevention of Mother to Child Transmission (PMTCT) were recorded. In 2009, 201 positive cases were recorded comprising of 134 CT and 67 PMTCT respectively.

North Tongu District: There are 3 hospitals, 8 health centers, 9 clinics and 1 CHPS center. Distribution of health facilities in the district is skewed in favor of large towns such as, Juapong, Volo, Torgorme, Podoe, Dorffor Adidome, The Catholic Hospital at Battor is the biggest of all the health facilities and is the District Hospital. It receives a lot of referral cases from the other health
centres. The Hospital is noted for its specialty in Hernia, Fibroid & goiter treatments. The HIV/AIDS records of the district were not available for inclusion in this report. However, the HIV/AIDS prevalence among pregnant women attending ANC clinics in 2009 in the Volta Region was 2.6 (this was below the national average of 2.9).

2.6.17 Historical, Cultural and Heritage Resources

Asuogyaman, Dangme West and North Tongu Districts: There are some prominent heritage resources within the project zone of influence which will not be affected by the Proposal. These are very symbolic cultural and historic assets which need to be preserved and protected during the project implementation program. Because of the presence of such delicate cultural resources such as sacred grove, shrines and cemeteries which will not be affected by the roads project, a detailed heritage sensitivity assessment will be recommended to be carried out prior to the Proposal implementation.

Section 1: Asutsuare Junction – Volivo Road (28.3Km): The absence of historical, cultural or archaeological resources within and/or outside the immediate surroundings of this project road eliminates any significant impacts of the project development on heritage sites. This road project implementation program will not have any potential negative impact on any listed historic resources. Where necessary, an archaeological sensitivity assessment should be carried out and all excavation activities should be supervised by experts for the potential discovery of chance find. Moving forward, as more detail on the ground disturbance of construction activities emerges, additional archaeological review should be undertaken, consistent with expert recommendations. This review should include reviewing geotechnical data (I.e. soil boring logs) and underground utility data to identify more precise areas of potentially intact soils where below ground resources may be present.

Section 3: Dufor Adidome – Asikuma Junction Road (38.4km): At the new Volta River Bridge site at Dufor Adidome, ch (0 + 000) km LHS, there is a sacred grove with two (2) shrines, male and female. The male shrine is called **Tsaduma Shrine** and the female shrine is **Venor Shrine**. The fetish priest who takes care of these shrines and administers traditional rituals and rites to appease the gods is **Fetish Priest Ernest**

Gakpetor. Around ch (0 + 800) km LHS, there is a public cemetery. These historical, cultural and heritage assets are not in the RoW and will be avoided to make way for the project road implementation program.

Section 2: Asutsuare – Aveyime Road (24.0km): At ch (0 + 000) km RHS and ch (1 + 100) km RHS are two (2) cemeteries which will not be affected by the project road development program. These cemeteries are Bosidom Cemeteries 1 and 2. The Adakorkpe Shrine, located at ch (14 + 500) km LHS, will not fall within the RoW of the project redevelopment alignment, therefore, will not require any displacement. An old royal cemetery at ch (24 + 500) km RHS and an old public cemetery at ch (24 + 800) km LHS are not directly within the new road improvement reservation width. A bypass new road will be constructed as part of the section 2 (Asutuare – Aveyime Road) project road to avoid all the historical and cultural heritage resources located at the tail end of this project road.

2.6.18 Water and Sanitation

Asuogyaman District: (i) Water Supply Access - The Eastern Region of Ghana is reputed to have the least percentage (31%) of potable water coverage according to a survey conducted by GWSC in 1992. This is against a national figure of 49% coverage. In Asuogyaman District apart from Akosombo, Akrade, Atimpoku and a few other settlements, majority of the settlements in the District lack potable water. A field survey conducted in 2012 revealed that the major rural water infrastructure facilities available for the supply of water in the district are boreholes, pipe borne, hand dug wells, streams and the Volta Lake. There are three (3) water treatment plants serving the District. These are the Kpong, Akosombo and Boso treatment plants. Communities along the main road corridor to Akosombo are either served by the Kpong or Akosombo distribution system. Towns in Anum and Boso Zone are served with water from the treatment plant at Boso. Settlements that are served with pipe-borne water include Akosombo, Atimpoku, Anum, Boso, Akrade, Mangoase and Tusker.

Most settlements with pipe borne water still depend on wells, boreholes, streams and the Volta Lake as supplementary source of water. In Atimpoku for instance in-spite of the supply of pipe-borne water about 50% of those interviewed indicated that the Volta River is the main source of water supply. There are 45 boreholes and 13 wells in the District. Most of the wells are private while on the other hand, majority of the boreholes are public owned. A lot of the boreholes serve as the only source of potable water supply in the communities. Settlements mainly found in the Gyakiti and Frankadua/Apegueso zones and isolated ones like Tortibo, Sapor, Asikuma centre include communities around Tortibo, Sapor and Asikuma Mpakadan Domeabra Anyansu and Yaniama are without pipe borne water. For most of these settlements their main sources of water supply are boreholes, well and streams. Communities along the Volta River use the Lake as the main source of water supply. The rural water infrastructural facilities for the supply of water in the District include hand pumps, boreholes and water treatment and distribution systems. There are three water treatment and distribution systerms serving the District. These are the Kpong, Akosombo and Boso treatment plants. Communities along the main road corridor to Akosombo are either served by the Kpong or Akosombo distribution systems. Towns in Anum and Boso zone are served from the treatment plant at Boso. **(ii) Sanitation Evaluation:** Sanitation is of a much bigger problem in the District than water supply. Like at the national level, the sanitation development level is behind that of water systems. Sanitation facilities in the District consist principally of toilet facilities and a few others for ensuring proper hygienic conditions. These include water-close sets (WCs) mainly found in Akosombo, Anum and Boso, KVIPs, ordering Pit latrines and VIP. These WCs are privately owned by certain institutions and individuals. **(iii) Waste and Wastewater Evaluation:** Properly constructed drainage facilities care is virtually non-existent in the Distinct with domestic waste water running freely from homes on to walk ways. These waste waters get stagnant in little depressions within the settlements and serve as breeding

grounds for mosquitoes and other harmful insects. Also absent are proper hygienic methods of human waste as well as solid waste disposal. This results in the indiscriminate disposal of waste. Refuse is disposed of in heaps near rivers or at places near to food preparation sites. These disposal sites are breeding grounds for disease vectors and bacteria which pose serious health hazards for inhabitants of the settlements. It must also be noted that par latrines lack requisite specialists to empty the pans thus necessitating the phasing out of all these types of toilets. Currently CWSA is in collaboration with Assembly implementing a DANIDA funded Community Water and Sanitation Project. This project started in 1999 as a pilot phase of the eastern Region Community Water and Sanitation Program. Under the pilot phase of the project four (4) institutional latrines and one hundred and fifty (150) household latrines were constructed throughout the District by the end of January 2000. The construction of additional 50 VIP toilet facilities started in February 2000 and is currently on-going. **(iv) Sanitation Evaluation:** Sanitation facilities in the district consist principally of toilet facilities and few facilities for ensuring proper hygienic conditions in the Districts. These include Water closet s (WC mainly in Akosombo, Anum and Boso); Kumasi ventilated improved Pits (KVIPs), pit latrines, Pan Latrines and Ventilated Improve Pits (VIP's) the WC's are mainly owned institutions and private individuals.

Dangme West District: (i) Water Supply Access - Access to potable water supply in the project environmental is totally absent. This is due to the complete absence of surface water resources potential for treatment and connection, especially in the dry season. Such defective natural environmental conditions hinder the drilling of boreholes, hand-dug wells and dugouts. Moreover, potable water supply from Ghana Water Company Limited is also limited to urban centres such as Dodowa, Prampram, Ningo, Afienya, Asutsuare, Osuwem and Ayikuma. These areas are served by potable water supply resource from Kong and Osudoku Water Project, which often experience irregular water flow. In the rainy season, smaller communities within the district depend on dams, streams, rivers hand-dug wells and other dug-outs for sources of water supply for drinking and domestic use. In all, there are 58 boreholes in the districts which are currently functional **(ii) Sanitation Evaluation:** Human excreta disposal systems involve the use of three (3) facilities: KVIP, Pit Latrine and Bucket / Pan Latrine. The bucket/pan latrine use has declined due to associated problems such as lack of suitable disposal site and the unhygienic method of disposal. "Free range" also known as indiscriminate defection in open spaces, is popular and highly common in the district along the coastal and the forest areas. Sanitation management in the areas of solid and liquid waste disposal within the project environment and the district is ineffective. Refuse and household waste are disposed of indiscriminately, with the resultant creation of solid waste landfill sites. At these landfill sites, disposal of solid waste continues by dumping and burning. As a result, a potential increase in waste generation volumes is imminent. This has direct implications for the waste management needs of the district which is currently characterized by undesirable operational practices, poor and /or entirely absent of operational strategies. Waste disposal by open dumping promotes insanitary environmental conditions with the incidence of communicable diseases.

North Tongu District: (i) Water Supply Access - About 34.2% of households in the District surveyed in 2010 revealed that they use river/stream as their main source of drinking water. However, 44.6% of households in the rural areas use river/stream as their main source of drinking water compared to 19.2% in the urban areas of the District. Also, 16.3% of households in the district use public tap/standpipes as their main source of drinking water whilst 14.7% use pipe borne water outside the dwelling. Only 10.0% of households use pipe borne water inside the dwelling for drinking **(ii) Sanitation Evaluation:** There five (5) main toilet facilities in use in the District. The highest reported toilet facilities (or lack of it) used in the District are pit latrines 5,734 (30.9%), toilet facility 5,091 (27.4%), public toilet 4,837 (26.0%), Kumasi Ventilated Improved Pit Latrine (KVIP) 2,301 (10.9%) and water closet 721 (3.9%). Households who practice no facility (bush, beach and field) are more in the rural areas (35.0%). Also, households using WC

are more in the urban areas constituting 8.1% whilst only 1.0% use WC in the rural areas. About 6,419 (34.6%) of households use public dumps (open space) as their main source of refuse disposal. In the rural areas, 30.0% use public dumps (open space) as compared to 41.1% of urban households. Burning as a form of solid waste disposal is carried out by 5,250 (28.3%) households. With regards to liquid waste disposal, 12, 232 (65.8%) of households dispose liquid waste indiscriminately by throwing onto compounds. About 55.3% of urban households dispose liquid waste on compounds as compared to 73.1% in rural areas. Only 0.9% of households dispose their liquid waste through the sewerage system. About 1.9% households in the urban areas and 0.3% of rural households dispose liquid waste through a sewerage system.

2.6.19 Energy and Power Resource

Asuogyaman District: The main type of energy utilized in the District are electricity, charcoal fuel wood and Liquefied Petroleum Gas (LPG). Due to the government's rural electrification project and the proximity of the District to the Akosombo Hydro-electric Plant the numbers of settlements enjoying electricity have increased. Settlements enjoying electricity in the district includes Akosombo, Mangoase, Tursker, New and Old Akrade, Atimpoku, Senchi. The rest include Nnudu, Aboasa, Apegusu, Anum, Boso, and Adjena. Settlements with on-going electrification projects are Fintey, Osiabura, Yeniama Surveyline and Frankadua. All the major towns and villages in the district are expected to be connected to the National Grid by the end of 2003. Electricity is used for industrial, commercial and domestic purposes. Domestic use tends to be the most frequent in the district where it is widely used for lighting and to power household appliances. The use of electricity for cooking is uncommon except in Akosombo. Petrol, diesel and kerosene constitute a very important source of energy in the district. They are mainly used by vehicles and agricultural machinery such as sprayers, tractors and outboard- motors. Kerosene is generally used for lighting in communities which lack electricity and for lighting lamps during periods of power outage. Oil companies at filling stations supply fossil fuels. There are filling stations in four communities. The communities with filling stations are, Akosombo, Atimpoku, New-Akrade, and Asikuma. Charcoal and fuel -wood constitutes the predominant energy source for cooking in both the rural and urban areas of the district. Fuel-wood tend to be used more in the rural areas whereas charcoal is frequently use in urban communities. L P gas constitutes just about 3 percent of energy usage in the District. The cost of LP Gas is quite high and thus out of reach of most households in the District. As far as environmental protection is concerned electricity and LP gas are the safest. The only problem with these sources is that, they are relatively expensive compared to other sources. Facilities for the re-filling of gas cylinders are not available in the District and users go to Kpong for refilling which increase the cost to the consumer.

Dangme West District: Households in the District were asked about their main source of lighting facility in the house during 2010 survey. The response indicated that electricity through main national grid (53.7%) is the major source of lighting for households in the district. A significant percentage (32.0%) of households also uses the kerosene lamp whilst 11.2 percent also use flashlight/torchlight. A relatively low proportion of households 1.2% in the district use private generators; for a rural district, this is quite significant. The use of gas lamp, solar energy, firewood and crop residue for lighting are almost non-existent in the district. Households in both urban and rural areas mostly use electricity through main national grid with higher percentages of urban households 80.9% compared to 44.2% of their rural counterparts using electricity.

The use of kerosene lamp is however pronounced in rural areas (38.8%) than urban areas (12.6%). The source of fuel used for cooking in the District and the distribution by locality were also indicated. The main fuel used for cooking in the district is charcoal (45.7%) while 33.3 percent of households use wood to cook

and 16.4 percent also use gas. About 3.8 percent of households do not cook at all. Animal waste as fuel for cooking is the least used by households with an insignificant proportion. In urban households, the major fuel used for cooking is also charcoal (60.0%), 24.7 percent use gas and 10 percent use wood for cooking. The major fuel used in rural communities is wood 41.4% and charcoal 40.7% while significant proportion of households also uses gas 13.5 percent.

The survey data further provides information on cooking space used by households. The data shows that 34.3 percent of the households in the district cook their foods on verandahs followed by 27.8 percent of households that use separate rooms for exclusive use of the households. A significant proportion (20.7%) of households cook their food in open space in compound, while 5.8 percent also use structure with roof, but no walls and 4.9 percent do not have a cooking space at all. In urban households, verandah (47.5%) is main space used for cooking. Another 18.2 percent of the households also use kitchens to cook 19.0 percent cook in open space in compound whilst 3.7 percent do not have a cooking space at all. Rural households however use kitchen (31.2%) mostly in cooking whilst other households also use verandah (29.7%) and open space in compound (21.3%).

North Tongu District: A 2010 survey data depicted the main source of lighting of dwelling unit by type of locality. The main source of lighting for most households (48.9%) is kerosene lamp. A higher proportion of households using kerosene lamp as their main source of light is higher in rural (62.4%) than urban areas (29.3%). Out of the urban households in the District, 57.8 percent use electricity with 19.7 percent in rural areas also using electricity as their main source of lighting.

The main source of cooking space used by households also shows that a higher proportion of the households use a Separate room for exclusive use representing 40.5 percent for domestic activities with urban and rural proportions of 32.9 percent and 45.7 percent respectively. Open space in compounds (23.4%)) is the next commonest cooking space used by households with urban and rural proportions of (28.8%) and (19.6%) households respectively.

2.6.20 Transportation

Asuogyaman District: Transport facilities in the district include road, lorry parks and water transport. Road transport is by far, the most important mode of transport in the district. The Tema-Akosombo portion of the road is asphalt. The road network from Atimpoku to Anum and Boso is bitumen surfaced. The rest of the road network in the district is basically feeder roads. Akosombo has an inland water port at Marine managed by the Volta Lake Transport Company. The company has ferries which transport goods and people on the Lake to Afram Plains and Yeji in the North. The lake also provides opportunities for farmers who use canoes to the big market centre at Dzemeni in the South Dayi district of the Volta Region.

Dangme West District: The district has about 252 kilometers of road network; 40 percent is surfaced while the rest are feeder roads. Tracks and footpaths also link villages. The total road network when compared to other districts appears to have a good spatial distribution. Apart from the central portion of the district, which is devoid of roads, the rest of the district is fairly linked up. The road surface condition of the national trunk roads is of an appreciably good condition. However, the local arterials such as the Dodowa-Afienya road and Doryumu-Agomeda road need urgent improvements. Most of the feeder roads that give access to the more rural centres are unsurfaced and need regular resurfacing especially after the rainy season. Statistics about traffic on those roads such as traffic volume, vehicle fleet, traffic composition, hourly distribution, peak hour traffic, and passenger and freight movement are unavailable for the district. Surveys would have to be conducted to collect such vital data for future planning purposes. There is a

disused 14.8 kilometers railway line from Tema through Afienya to the Shai Hills used for the construction of the Tema Harbor. This line can be rehabilitated for urban transport.

North Tongu District: The District has a tarred road linking from the main Accra-Aflao road through Sege. Other communities such as Juapong are along the main Accra-to Ho road. There are also some motorable feeder roads within The District. Another form of transportation in the District is by river. The District is divided by a stretch of the Volta lake with communities such as Torgorme, Volo, Vome Battor and Mepe among others lying along the river.

2.6.21 Vulnerable Group

Asyougyaman, Dangme West and North Tongu District: Potential vulnerable groups often include children, aged, disabled and women. Potential vulnerable groups often also include "indigenous peoples" as used by donor institutions refer to social groups with a social and cultural identify distinct from the dominant society that makes them vulnerable to being disadvantaged in the development process. The people so described have been traditionally marginalized and exploited. Indigenous or tribal people are commonly known to be among the poorest segments of a population. They traditionally engage in economic activities that range from shifting agriculture in or near forests to wage labor or even small-scale market – oriented activities. With regards to the potential area of Project influence given the available data, there are populations subject to resettlement by the project.

2.6.22 Gender Equity and Mainstreaming

Asuogyaman, Dangme West and North Tongu Districts: (i) Gender Inequality - Gender equality is a goal that has been accepted by governments and international organizations. It is enshrined in international agreements and commitments. There are many ongoing discussions about what equality means (and does not mean) in practice and how to achieve it. There are global patterns to inequality between women and men. For example, women tend to suffer violence at the hands of their intimate partners more often than men; women's political participation and their representation in decision-making structures fall behind men's; women and men have different economic opportunities; women are over-represented among the poor; and women and girls make up majority of people trafficked and involved in the sex trade. These issues – and others – need to be addressed in efforts to promote gender equality. Achieving greater equality between women and men will require changes at many levels, including changes in attitudes and relationships, changes in situations and legal frameworks, changes in economic institutions, and changes in political decision-making structures (ii) **Marginalization of Women -** Generally, females are being marginalized resulting in the fact that their views not adequately captured in decision making and therefore making them vulnerable. A larger proportion of female head households exists due to migration of the male counterpart, child neglect etc. Most of the women however have no regular source of remittance. The domestic roles of women include taking care of children. Women are therefore saddled with the responsibility of providing food, clothes and in some cases the payment of school and hospital fees. The low income earned by these women, therefore inadequate to meet the needs of their households hence their disadvantaged positions economically. Social problems faced by women who have some relationships with poverty include the traditional social systems, fertility, conflicts and gender equity in personal and social relations. Also, in traditional legal systems, the perceptions of female roles combine to ensure that allocation of resources favor male authority and interest still exist. Some negative traditional practices, restrictions on pregnant and lactating mothers as well as serving the best and largest parts of the meal to the male members of the household, all conspire in no small measure towards worsening the lot and the general poverty-stricken position of most women in the district. Women

generally have lower access to land. When land allocations are made to women, they are normally given smaller acreages no matter their individual capabilities. The District Assemblies ensured that gender analysis and gender concerns are addressed in all planning activities when setting priorities, allocating resources and identifying actions and activities **(iii) Gender Mainstreaming -** Specific gender mainstreaming activities include the following: provision of adequate sanitary facilities for both male and female at all public places especially schools and health facilities due to the special needs of girls; analysis of development proposals in the light of how it affects both male and female and provide each facility adequately to address their needs; organization of sensitization programs for men and women to encourage cross gender participation in local governance; encourage more female aspirants to take political and public positions; form school clubs for girls to build their confidence and capacity to bridge the gap between boys and girls; supporting women trades groups in the districts in accessing resources for their activities; addressing the issue of women access to land for farming.

3 Beneficial and Adverse Impacts

3.1 Beneficial Impacts

The potential positive impacts of the proposal will be experienced on a long-term basis through induced characteristics. These induced transformation events are more socio-economic and cultural in nature. The potential key expected positive impacts of the proposals include the following: (i) the contribution to improvement of trade among project influence populations (ii) improved transport conditions of goods and populations in the relevant project roads sections (iii) the internal opening up and improved access to basic socio-economic infrastructure for the populations within the project roads enclave (iv) the creation of direct and indirect jobs and employment during the construction, operation and maintenance phases of the project roads implementation program (v) development of tourism potential (vi) improved and enhanced living conditions and social facilities for vulnerable populations served by the project roads (vii) reduced risks of landslides and erosion by strengthening and monitoring of slopes (viii) improved safety around schools, health centers, churches, mosques and other social amenities along the project roads catchment zones (xi) suppression of dust through bituminous surfacing of the project roads pavements (x) reduction in greenhouse gas (GHG) emissions (xi) reduction in travel time and costs (xii) reduced traffic congestion resulting from flooded road section conditions on the **Asutuare-Aveyime Road** during heavy precipitation conditions (xiii) improved travel safety and comfort (xiv) increased land values within the roads project enclave (xv) enhanced economy and gender development (xvi) improvement in agriculture, especially in rice, maize, cassava and vegetables cultivation using latest technology. Some key expected positive impacts have been discussed in the ESIA Report in Chapter 8 (Section 8.5).

3.2 Adverse Impacts

This has been disclosed in detail in the ESIA Report in Chapter 8 (Section 8.2) under pre-construction, construction and operation phase. The section highlights the following: impact analysis; potential negative impacts for the roads project consideration under **pre-construction phase** (survey works; work camp and site offices; removal of trees; demolition of structures, air quality, human health and safety); **construction and operation phases** (air quality; soundscape and vibration; borrow pits generation; soil erosion and sedimentation; waste generation and removal; water quality and supplies; concrete batch plant waste; construction camps and site offices; biodiversity; traffic and transportation; human health and safety; visual quality and amenities; history, archaeology, heritage resources; pedestrian-vehicular conflicts; public utilities and services; hydrology and drainage systems; project communities access; loss of assets

and compensation payment; influx population surge; greenhouse gas (GHG) emissions). Climate change and complimentary initiatives, including gender issues have been discussed in detail under the **operation phase.**

4 Enhancement/Mitigation Measures and Complementary Initiatives

The enhancement/mitigation measures have been given detailed discussion in the ESIA Report in Chapter 9 (Section 9.2). Concise description has been given in the subsequent section below.

4.1 Enhancement/Mitigation Measures

Mitigation for Air Quality: (i) construction vehicles maintenance (ii) watering of exposed surfaces (iii) cover vehicles carrying spoil (iv) install and maintain equipment mufflers.

Mitigation for Soundscape and Vibration: (i) installation of no horn signs postings at very sensitive receptor zones within the projects catchment areas (ii) trees and shrubs planting within the projects enclave to serve as noise control barriers (iii) comply with relevant legislations associated with noise and vibrations including any health impacts (iv) conduct surveys for noise nuisance and vibration compliance with Ghana EPA permissible levels within sensitive receptors corridor.

Mitigation for Borrow Pits Generation (i) all stagnant pools and ponds will be filled up with spoils using spoils from cuts, re-alignments and vegetation removal operations (ii) backfilling of all excavations will be undertaken (iv) stocked up topsoil will be utilized to re-contour the borrow areas.

Mitigation for Soil Erosion and Sedimentation: (i) use vegetation cover on exposed surfaces around the project's sites (ii) use improved drainage and storm-water structures to minimize runoff during precipitation events (iii) direct turnouts from drains into approved water systems by use of silt traps (iv) educate the project populations to continuously de-silt drains and other drainage structures from choking.

Mitigation for Waste Generation and Disposal: (i) develop an Anti-Litter Program Projects wide (ii) treated leachate and other liquid effluents from the projects enclave will meet sound Best Industrial Practice Guidelines requirements (ii) develop a Waste Disposal Policy for the projects sites and ongoing monitoring of compliance (iii) the policy will detail the schedule collection, minimize waste handling, and maximize waste containment, control odors and loss of waste, include recovery facilities and proper maintenance of collection vehicles to ensure safe collection and transportation of waste (iv) chemicals and oils to be delivered in bulk where possible to reduce the number of containers requiring disposal.

Mitigation for Water Quality and Supplies: (i) potable water supply needs for drinking by construction crew and GHA supporting staff will be provided by the contractor(s) (ii) quality of drinking water will be tested to ensure International Standards compliance such as Ghana EPA/ WHO and other regulatory compliance requirements.

Mitigation for Concrete Batch Plant Waste: (i) remove all damaged top soil from the concrete batch plant sites and dispose of according Ghana EPA regulations and district/metropolitan Bye-Laws (ii) re-contour sites to its original states and landscape where applicable (iii) implement Concrete Waste Management and Contaminated Soil Management Plans where applicable.

Mitigation for Construction Camps and Site Offices Creation (i) complete dismantling and removal of construction camps/offices through decommissioning activities (ii) dismantled or removed construction

camps/office recyclable materials will be recycled for reuse to deviate or direct waste materials disposal at landfill sites (iii) no waste, toxic materials or deteriorating structures remaining at camp sites after construction and operation phases.

Mitigation for Loss of Fauna and Flora: (i) re-vegetated areas monitored and maintained until there is evidence of stable cover by self-sustaining vegetation community growth (ii) Weed Management Plan implementation and no new weeds or increase in weed cover during monitoring period (iii) ensure stable landform without significant soil erosion (iv)
develop and implement Re-vegetation Plans.

Mitigation for Traffic and Transportation: (i) construct and monitor projects roads to a safe and stable flow standard (ii) minimize the erosion caused by the construction and operation of the projects roads (iii) minimize the impact on flora and fauna during maintenance of projects roads and water course crossings.

Mitigation for Human Health and Safety: (i) use of adequate projects roads improvement measures to reduce accident rates (ii) minimize risks/hazards to project roads users (iii) strengthen roads safety campaigns programs to be run in collaboration with National Road Safety Commission (NRSC).

Mitigation for Visual Quality and Amenities: (i) ensure compatibility and cohesion in terms of engineering designs, scale, massing and sitting of the new roads alignments and site camps/office buildings (ii) ensure that all the proposed projects roads trees plantings will comply with the GHA Projects Aesthetic and Landscape Guidelines (iii) follow a Lighting Plan developed by GHA (in consultation with stakeholders) for the Projects site camps/offices prior to the installation or replacement of any light standards on and around the Projects from lights on them.

Mitigation for History, Archaeology and Heritage Resources: (i) any projects road heritage and historic resource find in the construction and operation phases expansion works will be documented and reported to the Ghana Museums and Monument Board, through the Department of Archaeology and Heritage Studies of the University of Ghana, Legon (ii) all archaeological features will be given, where necessary, a predictable low probability of impact and occurrence at the operation stage.

Mitigation for Pedestrian-Vehicular Conflicts: (i) improved roads conditions will introduce roads side commercial, industrial and settlement developments requiring Traffic Management Plan implementation by GHA to control pedestrian-vehicular conflicts (ii) schools, health centers, churches and mosques, entertainment centers development will create human and vehicular traffic management by GHA (iii) motorists enticed to increase vehicular speed because of improved projects roads conditions leading to accident rates shoot up requiring traffic police intervention.

Mitigation for Public Utilities and Services: (i) opening-up of new settlement communities due to completed project roads will require increase in public utilities and services provision (ii) new commercial businesses, residential outlets, schools, health posts, etc. development will demand expansion in public utilities and services provision (iii) rural-urban sprawl emergence due to in-out migration patterns requiring new development schemes.
Mitigation for Hydrology and Drainage Systems: (i) runoff from projects roads will be directed into drainage channels and discharged into approved waterbodies located further away from settlement areas (ii) runoff from project roads will be channeled away from fertile agricultural farmlands to avoid damage to food crops and economic trees (iii) erosion protection works like grassed or stabilized slopes will be maintained constantly and inspected frequently to ensure effective operation.

Mitigation for Project Communities Access: (i) deploy traffic control devices, equipment and installations to warn motorists, pedestrians, cyclists, inform road users, guide road users. (ii) modify road user's behavior through traffic education (iii) protect road users and their vehicles, bicycles, motorbikes (iv) ensure safe passage to road users (v) provide a safe project's working zones.

Mitigation for Loss of Assets and Compensation Payment: (i) ensure the provision of detail guidelines for easy implementation of the RAP program (ii) deliver the entitlement to the PAPs and support the restoration of their livelihood in accordance with 2010 Resettlement Policy Framework of the Ministry of Transport (MoT) (iii) ensure timely compensation payment to PAPs to avert any social uproar and unrest from the PAPs (iii) identify strategies for effective public information dissemination, public consultation and participation of the PAPs to ensure success of the RAP program (iv) ensure that the standard of living of PAPs is improved or at least restored (v) compensation payments will be made to **1,475 PAPs** whose affected properties range from building/structures, crops and bare farmlands. The total interim compensation payment sum is about **GHc 26,292,463.89 (including GHc 4,563,154.89 for implementation and monitoring cost).**

Mitigation for Influx Population Surge: (i) GHA will develop and operate Influx Management Plan (IMP) to address projects induced migration incidence (ii) discourage the in-migration of prospective job seekers into the Projects enclave by enforcing "No Employment" signs at the Projects as a policy to prevent them from camping outside the Projects boundaries.

Mitigation for Greenhouse Gas (GHG) Emissions: (i) meet GHG requirements by completing GHG analysis and a discussion of the energy improvement related to the Projects (ii) include an assessment of GHG emissions generated by both stationary and mobile sources using standard methods and modeling assumptions.

Mitigation and Adaption for Climate Impacts: (i) selection of appropriate and adequate type of pavement (ii) proper design of drainage facilities or structures (iii) proper levels of roads embankments (iv) provision of dugouts and boreholes where appropriate (vi) increase the capacity of carbon sinks (through reforestation and/or planting trees along the project roads) (vii) achieve some reduction in GHG, mostly CO_2 emissions from transportation, a special focus on transport demand management needs to be adopted that seeks to influence changes in management practices or consumer behavior (viii) protecting the naturally available carbon sinks like forests and trees, or creating new sinks through silviculture at sites to be identified along the roads alignment.

4.2 Complementary Initiatives

Road Safety Campaign and Children's Traffic Education: (i) construction of foot bridges at designated crossings (ii) conduct, in collaboration with National Road Safety Commission (NRSC), road safety campaigns for communities and schools in the project areas both during construction and implementation (iii) finance production of propaganda materials for inclusion as extra-curricular activities in schools and introduction of Safety Wardens to assist children cross project roads.

Disruption to Utilities (Water Provision, Power Lines and Communication): (i) GHA, ECG and GWCL will set out service standards guiding the maximum period which each of the utilities can be disrupted before being reinstalled (ii) critical paths of importance are water supply systems and power lines.

HIV/AIDS and Communicable Diseases: (i) incorporate HIV/AIDS and Communicable Diseases Awareness and Education Campaigns as an effective way of dealing with a variety of HIV/AIDS or Health issues without stigmatization (ii) Wellness Centers will be attached to Hospitals, Clinics and CHPS Compounds within the project enclave to become a one-stop-shop for HIV testing and counselling, blood group matching, malaria testing, diabetic checks, STI testing and others.

Gender Mainstreaming Plan of Action: (i) develop a Project Specific Gender Plan of Action (ii) provision of ablution corners (iii) adequate and secure accommodation for women (iv) resting space dedicated for women (v) code of conduct to prevent abusive language and unwanted approaches at work place (vi) consideration of particular needs of both men and women especially during resettlement and compensation (vii) in the design and determination of activities aimed at the control of the spread of HIV/AIDS and STI (viii) construct market stalls at designated locations for the women trading in rice, maize, fresh foods (fruits and vegetables) (ix) sensitization program for host communities with regards to gender mainstreaming and equity in all aspects including participation of women during roads construction (x) education and awareness creation on prevention of gender based violence in the project areas.

Youth Involvement Program: (i) ensure youth involvement in various aspects of the project through apprenticeship training program at local garages along the project corridor (ii) youth will be sensitized to register their skills into database (iii) GHA/District and Municipal Assemblies/Association of Auto-Mechanical Garages will establish a mechanism to identify the youth who qualify for training to attend artisan courses at the Ho Technical University or Accra Training Institute (iv) trained youth will be given opportunities during construction to gain experience (v) the District and Municipal Assemblies/National AIDS Commission has a database on orphaned and vulnerable youth in the project areas that are qualified to work on the construction sites or be employed in the Wellness Centers (vi) GHA/District and Municipal Assemblies will ensure that trained youth and orphans are employed on the project.

Landscaping and Trees Planting Program: (i) replacing trees that may be cut down during construction (ii) protection of the roads reservation (iii) planting trees that will contribute towards sequestration carbon emissions (iv) GHA will engage a Landscape Architect to develop a suitable design and specifications for the roads project setting.

Resettlement/Compensation (RAP): (i) during consultations and engagement with the PAPs, the impacts of the project and proposed mitigation measures were explained to them and they individually gave assurances that they will cooperate to ensure smooth implementation of the project (ii) further consultations and engagements will be held prior to the payment of compensations to the individual PAPs (iii) PAPs will be notified about compensations due them and where to collect the compensation (iv) PAPs will also be notified of the start date of civil works. See Table 11.0 for potential environmental and social impacts and mitigation measures matrix for project roads.

Table 11.0 Potential Environmental and Social Impacts and Mitigation Measures Matrix for Project Roads

Project Activities	Mitigation Measures for Expected Impacts	Magnitude of Extent	Likelihood	Phase and Duration	Overall Significance	Estimated Total Cost (USD)
Survey Works	Limited, localized opening of de-bush line. Limited vegetation cover removal.	Definite	Short Term	Pre-Construction Period. Local level.	Minor	See ESMP Cost Budget

Work Camp & Site Offices	Provision of mobile toilet and sanitary facilities. Daily collection of solid waste. Selection of flat location. Removal of vegetation cover.	Definite.	Medium Term	Pre-Construction Period. Local level.	Moderate	See ESMP Cost Budget
Removal of Trees (Flora Content)	Cutting and removal of limited number of trees. Removal and stockpiling of vegetation cover topsoil. New trees saplings to be promptly planted.	Definite	Long Term	Pre-Construction Period. Local level.	Moderate	See ESMP Cost Budget
Demolition of Structures	Reuse salvageable materials. Conduct asbestos and lead-based paint survey. Use health and safety controls.	Definite.	Long Term	Pre-Construction Period. Local level	Moderate-Minor	See ESMP Cost Budget
Air Quality	Fugitive emissions localized. Limited dust generation. Limited site clearance.	Definite	Short Term	Pre-Construction Period. Local level.	Minor	See ESMP Budget
Human Health and Safety	Use of PPE by workforce. Setup health education programs. Prevent accidents.	Definite	Short Term	Pre-Construction Period. Local level.	Minor	See ESMP Cost Budget
Air Quality	Construction vehicles maintenance. Watering of exposed surfaces. Cover vehicles carrying spoil. Install and maintain equipment mufflers.	Definite	Short Term	Construction Period. Local level	Minor	See ESMP Cost Budget
Soundscape & Vibration	Install sound control devices. Switch-off idling machines. Provide ear plugs to workers. Provide padded seats for equipment operators.	Definite	Short Term	Construction Period. Local level.	Minor	See ESMP Cost Budget
Borrow Pits Generation	Access vector ecology in work areas. Employ adequate drainage. Fill methodology to avoid creating mosquito habitats.	Definite	Short term	Construction Period. Local level	Moderate-Major	See ESMP Cost Budget
Soil Erosion and Sedimentation	No major earthworks during the rainy season. Limited vegetation cover removal.	Definite	Short Term	Construction Period. Local level.	Moderate-Major	See ESMP Cost Budget

	Use adequate drainage structures.					
Waste Generation and Removal	Minimize waste generation. Segregate waste for reuse. Provide waste bins. Develop disposal policy.	Definite.	Short Term	Construction Period. Local level.	Moderate-Major	See ESMP Cost Budget
Water Quantity and Supplies	Provision of water supplies by contractor. Avoid using project communities water sources.	Probable	Short Term	Construction Period. Local level.	Minor	See ESMP Cost Budget
Concrete Batch Plant Waste	Reuse concrete products. Prevent dumping of concreate waste. Segregate areas into “clean” and “dirty” sections.	Definite	Short Term	Construction Period. Local level.	Minor	See ESMP Cost Budget
Construction Camps and Site Offices	Carefully site, construct and manage construction camps. Control erosion and dust. Plan and carry out post-construction site clean-up.	Definite	Short Term	Construction Period. Local level.	Moderate	See ESMP Cost Budget
Loss of Flora and Fauna	Control all clearing activities. Minimize number of trees to be felled. Reduce potential impact of flora and fauna.	Definite	Long Term	Construction Period. Local level.	Moderate	See ESMP Cost Budget
Traffic and Transportation	Set and enforce speed limits. Regulate transport of toxic materials. Reduce accident risks by safe driving speeds.	Definite	Short Term	Construction Period. Local level.	Moderate	See ESMP Cost Budget
Human Health and Safety	Use of PPE by workforce. Collect and recycle lubricants. Take precaution to avoid accidental spills. Setup health education, HIV/AIDS/STDs/Malaria/Ebola.	Definite	Short Term	Construction Period. Local level.	Major	See ESMP Cost Budget
Visual Quality and Amenities	Fence in project sites and open spaces to prevent visual intrusion. Water all exposed areas. Ensure that new developments are culturally sound, environmentally and socially appropriate and aesthetically acceptable.	Definite	Short Term	Construction Period. Local level	Moderate.	See ESMP Cost Budget
History, Archaeology,	Assess heritage value of planned sites.	Possible	Long Term	Construction Period.	Minor	See ESMP

Heritage Resources	Alert Department of Archaeology Heritage Studies (University of Ghana, Legon) on discovery of any object of possible archaeological significance.			Local level.		Cost Budget
Pedestrian-Vehicular Conflicts	Provision of pedestrian access and walkways. Potential conflict spots will be marked with appropriate road signs. Provision of road signs warning motorists.	Probable	Short Term	Construction Period. Local level.	Minor	See ESMP Cost Budget
Public Utilities and Services	Locate all public utility lines in the RoW. Relocate all public utility lines outside roads project RoW. Engage and consult all public utility line agencies for relocation plans implementation approval.	Possible	Short Term	Construction Period. Local level.	Minor	See ESMP Cost Budget
Hydrology and Drainage Systems	Diligent execution of earthworks. Create settlement basins or vegetated runoff catchments. Provide oil traps to control leaks and spillage.	Possible	Long Term	Construction Period. Local level.	Moderate	See ESMP Cost Budget
Project Communities Access	Meet social concerns of project communities. Provide access for pedestrians, cyclists, motorist and project residents. Provide warning signs for motorists.	Probable	Short term	Construction Period. Local level.	Minor	See ESMP Cost Budget
Loss of Assets and Compensation Payment	Identify all affected properties in the RoW. Hold consultation and engagement meetings with PAPs. Mark out roads reservation corridor. Payment of compensation monies to PAPs.	Definite	Long Term	Construction Period. Local level.	Major	See ESMP Cost Budget
Influx Population Surge	Educate workforce on social harmony. Establish positive relation between workers and project residents.	Definite	Short Term	Construction Period. Local level.	Minor-Moderate	See ESMP Cost Budget

Greenhouse Gas (GHG) Emissions	Service construction machinery and equipment regularly. Capture GHG emissions for mobile construction vehicles and stationary equipment.	Probable	Long Term	Constructio n Period. Local level.	Unknown	See ESMP Cost Budget
Air and Soundscape Quality	Monitor periodically ambient air and noise quality at designated areas. Provide barriers in front of sensitive receptors. Enforce Ghana EPA guidelines for air and noise emissions.	Definite	Long Term	Operation Period. Local level.	Minor	See ESMP Cost Budget
Borrow Pits generation	Fill up all stagnant pools and ponds. Backfill all excavations. Re-contour areas with stocked up topsoil.	Possible	Medium Term	Operation Period. Local level.	Major	See ESMP Cost Budget
Soil Erosion and Sedimentatio n	Revegetate exposed surfaces. De-silt drains of chocked materials. Use silt traps to restrain turn-outs.	Possible	Medium Term	Operation Period. Local level.	Moderate	See ESMP Cost Budget
Waste Generation and Disposal	Prevent littering of project sites. Prevent unapproved landfill creation. Reduce, reuse and recycle waste materials.	Probable	Medium Term	Operation Period. Local level.	Moderate	See ESMP Cost Budget
Water Quality and Supplies	Test quality of drinking water. Ensure Ghana EPA/WHO regulatory standards.	Probable	Short Term	Operation Period. Local level.	Minor	See ESMP Cost Budget
Concrete Batch Plant Waste	Remove all damaged top soil. Dispose of concrete waste according to approved standards. Re-contour sites to original states.	Possible	Short Term	Operation Period. Local level.	Minor	See ESMP Cost Budget
Construction Camps and Site Offices Creation	Complete dismantling and removal camps and offices. Recycle all recyclable materials to deviate waste materials to landfill sites.	Probable	Long Term	Operation Period. Local level.	Moderate	See ESMP Cost Budget
Loss of Flora and Fauna	Re-vegetate areas monitored to sustain vegetation community growth.	Possible	Long Term	Operation Period. Local level.	Major	See ESMP Cost Budget

Traffic and Transportation	Minimize impact on flora and fauna during maintenance stage. Monitor traffic flow safety and hazards.	Probable	Long Term	Operation Period. Local level	Moderate	See ESMP Cost Budget
Human Health and Safety	Reduce accident rates through improved measures. Minimize risks to project road users.	Definite	Long term	Operation Period. Local level.	Major	See ESMP Cost Budget
Visual Quality and Amenities	Trees planting program should be carried out. Remove visually offensive structures and heaps of waste materials.	Probable	Medium Term	Operation Period. Local level	Minor	See ESMP Cost Budget
History, Archaeology, Heritage Resources	Any 'chance find' from roads expansion program will be documented. Report 'chance find' to Ghana Museums and Monument Board.	Probable	Long Term	Operation Period. Local level.	Minor	See ESMP Cost Budget
Pedestrian-Vehicle Conflicts	Remove improved roads condition leading to roads side commercial, industrial and settlement developments creating conflicts. Prevent development of social amenities (schools, health centers, churches, mosques, etc.) close to project roads leading to conflicts.	Definite	Long Term	Operation Period. Local level.	Major	See ESMP Cost Budget
Public Utilities and Services	Control new developments exacting devastating toll on provision of public utility services. Control urban sprawl emergence due to in-out migration.	Definite	Long Term	Operation Period. Local level.	Minor	See ESMP Cost Budget
Hydrology and Drainage System	Maintenance of grassed or stabilized slopes. Direction of runoffs from roads project away from fertile agricultural lands.	Possible	Long Term	Operation Period. Local level.	Moderate	See ESMP Cost Budget
Project Communities Access	Warn motorists, pedestrians, road user's behavior with traffic control devices. Ensure safe passage to project residents by	Definite	Long term	Operation Period. Local level.	Moderate	See ESMP Cost Budget

	provision of walkways or sidewalks facilities.					
Loss of Assets and Compensation Payment	Ensure success of RAP program. Maximize involvement of PAPs during implementation of RAP program. Provide adequate and acceptable compensation payment monies to all PAPs.	Definite.	Long Term	Operation Period. Local level.	Major	See ESMP Cost Budget
Influx Population Surge	Control induced migration incidence. Discourage in-migration of job seekers into project corridor by use of "No Employment" signs – prevent them from camping outside project boundaries.	Definite	Long term	Operation Period. Local level.	Major	See ESMP Cost Budget
Greenhouse Gas (GHG) Emissions	Monitor GHG emissions sources within project corridor.	Probable	Long Term	Operation Period. Local & Regional levels.	Unknown	See ESMP Cost Budget
Climate Change and Complimentary Initiatives	Selection of appropriate and adequate type of pavement design. Proper design of drainage structures. Proper levels of roads embankment. Provision of dugout and boreholes where appropriate. Roads safety campaign and children's traffic education. Disruption to utilities. HIV/AIDS and Communicable Diseases Awareness and Education. Gender Mainstreaming Plan of Action. Youth Involvement Program. Landscaping and Trees Planting Program. Resettlement/Compensation (RAP) Payments.	Possible	Long Term	Operation Period. Local level.	Major	See ESMP Cost Budget
Gender Issues	Ensure equal opportunities for men and women in line with AfDB Policy on Gender.	Definite	Long Term	Operation Phase. Local level.	Major	See ESMP Cost Budget

	Provision of ablution corners. Resting place dedicated to women. Consideration of needs of men and women during RAP implementation. Construction of market stalls for women.					

Sources: KE&T Data Records

5 Environmental and Social Monitoring Program

The environmental and social monitoring program will operate through all phases of the project and will monitor all aspects entailed in the ESMP. It will consist of activities, each with specific purpose, key indicators and significance criteria. The following aspects will be subjected to monitoring (See Table 12.0).

Table 12.0 Environmental and Social Monitoring Program with Cost Component

Impact Receiver	Monitoring Elements	Measuring Indicators (Indicative)	Follow-up Period (Phases)	Monitoring Frequency and Cost (USD)	Responsibility
Air	Pollution with respect to TSP, SPM, RMP, NO_x, SO2, CO.	Importance of dust and exhaust fumes take-off: Dust levels from construction activities. Exhaust fumes levels from construction vehicles, equipment and machinery.	During pre-construction, construction and operation	Monthly. USD 10,902.10	Contractor, GHA, EPA, Supervision Consultant
Noise	Pollution with respect to L_{10}, L_{90} and L_{eq}	Importance of effect levels from construction activities. Nuisance to sensitive receptors (schools, health centers, project residents). Nuisance to workers.	During pre-construction, construction and operation	Monthly. USD 5,451.05	Contractor, GHA, EPA, Supervision Consultant
Soil	Erosion and sedimentation of surface water bodies.	Gully from borrow sites and quarries. Scour the right of	During pre-construction, construction and operation.	Monthly pre-construction and construction phases. Bi-	Contractor, GHA, EPA,

	Pollution and contamination of groundwater.	works in the operation phase. Soil contamination and ground water pollution.		annually operation phase. Monthly. USD16,353.14	
Waters	Pollution and contamination of surface and ground water resources due changes in hydrology, drainage and use of water and ground water resources. Pollution with respect to BOD, COD, conductivity, fecal matter, oil and grease, arsenic.	Physiochemical for surface waters. Physiochemical and bacteriology for drilling and excavation for drainage structures.	During pre-construction, construction and operation.	Quarterly. USD 21,804.19	Contractor, GHA, EPA, Water Resources Commission, Supervision Consultant.
Vegetation and Fauna	Revegetation for borrow sites, quarries and roads sides landscaping. Wildlife disturbance. Destruction of wildlife habitats.	Plantation success rates. Number of accidents involving animals. Number of destroyed habitats.	During construction and operation.	Quarterly in the construction phase. Annual operation phase. USD 27,255.24	Contractor, GHA, EPA, Forestry Commission, Supervision Consultant.
Waste Generation and Disposal	Poor waste disposal leading to disease spread. Wildlife deaths linked to poor waste disposal. Poor sanitation effects.	Frequency of waste disposal success rate. Waste Management Plan implementation success rate. Effectiveness of Environmental Audit.	During pre-construction and construction.	Monthly. USD 32,706.29	Contractor, GHA, EPA, District and Municipal Assemblies, Supervision Consultant.
Historical, Cultural and Archaeological Resources (Sacred Sites)	Protection, preservation and conservation.	Number of protected, preserved and conserved sites.	During pre-construction, construction and operation.	Monthly. USD 38,157.33	Contractor, GHA, EPA, District and Municipal Assemblies, Museums and Monuments Board,

					Supervision Consultant.
Land	Changes due to disappearance of public areas. Disappearance of vital and critical biodiversity.	Land use and re-zoning plans.	During pre-construction, construction and operation.	Monthly during pre-construction and construction phases. Bi-annually operation. USD 43,608.38	Contractor, GHA, EPA, Lands Commission, District and Municipal Assemblies, Town & Country Planning, Supervision Consultant.
Public, Occupational Health and Safety	Disease spread from HIV/AIDS/STDs.	Prevalence rate. Effectiveness of awareness creation Programs. medical records and statistics.	During construction and operation.	Monthly during construction phase. Annual operation. USD 49,059.43	Contractor, GHA, EPA, MoH, GHS, District & Municipal Assemblies, Supervision Consultant.
Road Safety	Traffic accidents records. Police records and reports.	Number of accidents in pre-construction and construction phases. Total number of accidents in operation phase.	During pre-construction, construction and operation.	Monthly. USD 54,510.45	Contractor, GHA, EPA, National Roads Safety Commission, District & Municipal Assemblies, Supervision Consultant.
Indemnification and compensation for loss of assets.	Destruction of crops, farms, buildings & structures, bare lands.	Status of compensation for assets affected by project works.	During pre-construction, construction and operation.	Monthly during construction phase. Annual during operation. USD 190,786.67	Contractor, GHA, EPA, Land Commission (Land Valuation Division), District & Municipal Assemblies, Supervision Consultant.
Socio-Economic	Employment, job creation and improved income.	Number of jobs created through employment. Average income in districts and municipalities affected by the project.	During pre-construction, construction and operation.	Monthly employment. Annual average income. USD 49.059.43	Contractor, GHA, EPA, Labor Commission, District & Municipal Assemblies, Supervision Consultants.

Gender	Employment of women. Complaints of gender bias. Reported cases of women rape victims.	Number of jobs created for women. Average income of women workers in districts and municipalities affected by the project.	During pre-construction, construction and operation.	Monthly employment. Annual average income. USD 5,451.05	Contractor, GHA, EPA, Labor Commission, Women & Children Ministry, District & Municipal Assemblies, Supervision Consultants.

Source: KE&T Data Records

The objectives of the environmental and social monitoring, mitigation measures monitoring, responsibilities for mitigation monitoring and external monitoring programs are the following: (i) quantitatively measure the environmental and social effects of the roads project (ii) monitoring environmental and social impacts through pre-construction, construction and operation phases (iii) mitigation monitoring to be undertaken by Contractor(s) Environmental and Social Manager (ESM) and Engineers' Environmental and Social Specialists (ESS), these officers will conduct mitigation monitoring as part of the regular works inspections (iv) weekly inspections will be undertaken by Contractor(s) ESM, when available and appropriate the inspection will also be attended by Engineers ESS, the main Contractor(s) site management staff and their specialist advisors (v) weekly Environmental Compliance Report will be produced following each inspection and will incorporate any actions identified by the client including status of site's compliance and photographs (vi) responsibilities for mitigation monitoring at the operation phase rests with GHA Environmental and Social Division as the implementing agency (vii) GHA will provide AfDB with reports on environmental and social compliance during implementation as part of their annual progress reports and annual environmental and social monitoring reports (viii) depending on the implementation status of environmentally and socially sensitive areas of the project corridor, AfDB will perform annual environmental and social reviews in which environmental and social concerns raised by the project residents will be reviewed alongside project implementation (ix) AfDB requires that an Environmental and Social Audit be undertaken within twelve (12) months of commencement of the project to monitor the implementation of the ESMP (x) Environmental and Social Audits will be part of the continuous monitoring program to help determine the long-term effects of adopted mitigation measures (xi) audits will uncover the actual performance of mitigation measures and allow effective measures to be included in future projects (xii) Environmental and Social Audits will be a responsibility of an AfDB Consultant contracted by GHA. Detailed information on the environmental and social monitoring program has been captured in the ESIA Report in Chapter 11.

6. Consultations

As part of the stakeholder consultations and engagements program, the KE&T ESIA/RAP Study Teams held six (6) public meetings on 18/10/2014, 05/12/2014. 06/12/2014, 26/06/2015, 27/06/2015 and 13/11/2015 along the roads project enclave during the development of the ESIA and RAP Reports. Moreover, the KE&T ESIA Study Team, GHA and AfDB Project Design Teams held Stakeholders Community Needs Assessment public meetings on 18/04/2018 at Asutuare Junction, Asutuare, Volivo, Aveyime and Dofor Adidome along the project roads corridor. Finally, KE&T ESIA/RAP Study Teams, GHA RAP and AfDB ESIA/RAP Teams held Stakeholders ESIA/RAP

Awareness Education public meetings on 20/04/2018 at Asutuare Junction, Asutuare, Volivo and Aveyime. The same program was slated to have been held the following day (21/04/2018) at Dofor Adidome but due to funeral celebration, this program could not come on since the project community residents attended the funeral celebration. The participants of the various public meetings included the following (i) representatives of community-based associations such as the Ghana Private Road Transport Union (GPRTU), Drivers, Taxi Owners (ii) Market Women, Rice Traders, Teachers, Parents, Home Owners, Property Developers (iii) Nurses, Assembly Men and Women, Elders, Opinion Leaders (iv) Rice Farmers, Fruits and Vegetable Farmers, Project-Affected-Persons (PAPs) and Project Community Residents.

The stakeholder consultative and engagement meetings provided: (i) views, opinions and suggestions on the most appropriate considerations on the construction and use of the proposed roads project (ii) measures to address fears and concerns during construction (iii) assurance that both women's and men's views were taken on board in the project design (iv) means of undertaking public consultations in an all-inclusive manner (v) community participation and instant feedback into the project design especially related to matters of road alignment, RoW and shoulders design, resettlement and compensation payment (vi) awareness creation and identified positive and negative socio-economic impacts of the roads project, proposed mitigation measures to address the potential impacts during pre-construction, construction and operation phases programs,

The following are some of the issues and concerns raised at the meetings which were responded to and as much as possible with recommendations made which have been incorporated in project design: (i) road safety measures for school children (ii) public appreciation and concerns of the roads project due to their importance (iii) high expectations (direct and indirect jobs creation and employment generation from the project, development and improvement of businesses, provision and enhancement of access to social amenities, reduction of travel time) (iv) fears and concerns associated with the roads project including increased road accidents and increased HIV/AIDS/STDs (v) timely and fair compensation payments (v) road drainage and flooding especially on Asutuare-Aveyime Road and Dofor Adidome-Asikuma Junction low-lying wet land sections (vi) establishment of toll plaza (viii) waste generation and disposal along the project roads corridor (vii) traffic management and security provisions for road users during construction (viii) establishment of a Grievance Redress Mechanism for PAPs and all road users and the need for continuous information sharing (ix) noise and excessive vibrations during construction (x) public infrastructure and utilities disturbance or destruction repairs during construction works.

Summary of Stakeholder Community Needs Assessment: The AfDB Project Design Team mission was to visit the project roads corridor consult and interact with the affected project populations and assess the community needs. Such needs will be prioritized and factored into the project budgetary provisions for approval by the board. Moreover, the AfDB Project Design Team wanted to know and assess how the project will affect the communities, livelihoods and future planned programs. The summary of stakeholder community needs assessment is detailed in Table 13.0.

Table 13.0 Summary of Stakeholder Community Needs Assessment

Serial Number	Project Location	Community Needs	Commentary
1	Asutuare Junction	CHPS compound facility, community center, JHS/SHS School, Borehole, pipe borne water supply, public toilet, market, timely PAPs compensation payment, employment priority for youth.	Public meeting held on 18/04/2018. Attendance by KE&T ESIA/RAP/Project Design Team, GHA and AfDB Project Design Teams and Community Residents.
2	Asautuare	New Market, pipe borne water, public toilet, employment priority for youth, upgrade lorry park, timely PAPs compensation payment.	Public meeting held on 18/04/2018. Attendance by KE&T ESIA/RAP/Project Design Team, GHA and AfDB Project Design Teams and Community Residents.
3	Volivo	Completion of CHPS compound facility, pipe borne water, public toilet. Jobs and employment for youth, market, business assistance loans for traders, community center.	Public meeting held on 18/04/2018. Attendance by KE&T ESIA/RAP/Project Design Team, GHA and AfDB Project Design Teams and Community Residents.
4	Aveyime	Clinic, pipe borne water, ICT center (present in dilapidated building), community center, jobs and employment for youth, gari processing factory.	Public meeting held on 18/04/2018. Attendance by KE&T ESIA/RAP/Project Design Team, GHA and AfDB Project Design Teams and Community Residents.
5	Dofor Adidome	Pipe borne water, dams for animals and people, hospital, market, technical-vocational school, ICT laboratory, public toilet, teacher's bungalow and nurse's accommodation, employment for youth, nursery school, PAPs compensation prompt payment, police quarters for project personnel protection.	Public meeting held on 18/04/2018. Attendance by KE&T ESIA/RAP/Project Design Team, GHA and AfDB Project Design Teams and Community Residents.
6	Asikuma Junction	Pipe borne water, market, public toilet JHS/SHS, technical and vocational school, clinic, PAPs compensation	Public meeting held on 18/04/2018. Attendance by KE&T ESIA/RAP/Project Design Team, GHA and AfDB

		payment, jobs and employment for youth.	Project Design Teams and Community Residents.

Source: KE&T Data Records

Stakeholder Community ESIA/RAP Reports Awareness Education: The AfDB ESIA/RAP Team mission was to visit the project roads corridor consult and interact with the affected project populations and educate the community on the provisions of the ESIA and RAP Reports. Such provisions dealt with project pollution concerns and controls which have been factored into the project budgetary provisions for approval by the board. The AfDB ESIA/RAP Team wanted to know and assess how the PAPs are dealing with the project displacement of assets and properties impinged upon by the roads project alignments. Moreover, the team wanted to assess the effects of the project roads on the communities, livelihoods and future planned programs. The summary of stakeholder community ESIA/RAP Reports Awareness Education is shown in Table 14.0.

Table 14.0 Summary of Stakeholder Community ESIA/RAP Reports Awareness Education

Serial Number	Project Location	ESIA/RAP Reports Awareness Education	Commentary
1	Asutuare Junction	**Appreciation**: improved roads condition; improved transportation; increased social and economic interaction; increased commercial activities. **Concerns:** air pollution; noise pollution; pollution of water resources; destruction of natural vegetation; disturbance of natural habitat of wildlife; Location of borrow pits; pedestrian consideration; project compatibility with general planning schemes and adjoining land uses.	Public meeting held on 20/04/2018. Attendance by KE&T ESIA/RAP Team, GHA and AfDB ESIA/RAP Teams and Community Residents.
2	Asautuare	**Appreciation**: improved roads condition; improved accessibility to natural resources; enhanced socio-economic development. **Concerns:** adequate consultation with relevant stakeholders;	Public meeting held on 20/04/2018. Attendance by KE&T ESIA/RAP Team, GHA and AfDB ESIA/RAP Teams and Community Residents.

		proper location of borrow areas and their reinstatement; water pollution; construction traffic and safety; noise and air pollution; inadequate; compensation for PAPs.	
3	Volivo	**Appreciation:** development of their respective communities; creation of employment opportunities; increase commercial activities; improved roads condition. **Concerns:** development of their respective communities; creation of employment opportunities; increase commercial activities. Improved roads condition.	Public meeting held on 20/04/2018. Attendance by KE&T ESIA/RAP Team, GHA and AfDB ESIA/RAP Teams and Community Residents.
4	Aveyime	**Appreciation:** Road Sector Development Program attainment; socio-economic development opportunities; traffic congestion removal; improved traffic flow; enhanced vehicular availability. **Concerns**: construction site camps/offices location; Settlement farmlands destruction; water resources pollution; noise and dust pollution; relocation of affected utilities; envisaged changes in project roads alignments effect on land uses.	Public meeting held on 20/04/2018. Attendance by KE&T ESIA/RAP Team, GHA and AfDB ESIA/RAP Teams and Community Residents.
5	Dofor Adidome	**Appreciation:** Easy transportation; cheaply acquired goods accessibility; development of towns	Public meeting held on 20/04/2018. Attendance by KE&T ESIA/RAP Team, GHA and AfDB ESIA/RAP

		and villages along the roads; population increase along project roads; increase and access to social amenities provision. **Concerns:** Increase in HIV/AIDS/STDs infections; loss of family values; properties destruction; destruction of wildlife habitats; accidents from speeding vehicles.	Teams and Community Residents.

Source: KE&T Data Records

7. Responsibilities and Institutional Arrangements

The relevant stakeholders to be involved in the ESIA monitoring program during project execution will most likely be: Client (GHA); Financiers; Project Consultants; Ghana Water Company Limited (GWCL); Electricity Company of Ghana (ECG); Ghana Health Services (GHS); Ghana Environmental Protection Agency (EPA); Forestry Commission (FC); District/Metropolitan Assembly; Ministry of Transport; Ministry of Energy; Projects Organizations and Non-Governmental Organizations (NGO's).

Depending on the implementation status of environmentally sensitive project activities, the regulatory agencies and GHA will perform annual or bi-annual environmental and social reviews in which environmental and social concerns raised by the project will be reviewed alongside project implementation. The implementation of environmental and social measures or components will be concurrent with that of the work and incorporated upon delivery of work.

The organizational and staffing structure identifying the personnel (by job title and name) and relevant institutions to be assigned for ESIA monitoring issues to be addressed with responsibility assignment to the Project is shown in **Table 15.0.**

Table 15.0 Organization and Staffing Structure with Site Management Roles and Responsibilities

Number	Designation	Roles and Responsibilities
1.	Project Environmental and Social Coordinator	• Responsible for day-to-day environmental and social management of project sites • Organize activities to motivate and maintain the interest of project staff in environmental and social issues. • Create awareness of environmental and social issues through training programs and review meetings. • Coordinate investigations on all types of accidents. • Conduct environmental and social audit in line with project monitoring guidelines.

		• Produce environmental and social reports on the project. • Coordinate with EPA and other relevant institutions. • Develop work plan for the implementation of the ESMP • Meet twice per month with consultant and contractor to discuss work requirements, compliance issues, environmental and social matters. • Inspect various aspects of the work areas and equipment for general housekeeping, dust, fumes, noise and compliance with spill prevention plan • Monitor environmental and social parameters for comparison with available or proposed standards. • Provide reports on environmental and social compliance during implementation as part of their monthly, quarterly progress reports and annual environmental and social monitoring reports to GHA, AfDB and EPA.
2.	Project Manager (Contractor)	• Construction methods and standardized materials under contract usage. • Overall supervision of project implementation work program, contract specifications and conditionalities attainment. • Liaison with Client on project implementation challenges, and timeliness of project execution.
3.	Project Manager (Consultant)	• Ensures that Contractor(s) meets its environmental, social, health and safety obligations to the project implementation work program.
4.	Client, GHA Representative	• Ensures that project execution meets specified environmental, social, health and safety guidelines contained in the contract documents and ESMP. • Responsible for negotiation procedures and compensation calculations. • Responsible for reporting on resettlement issues and restoration of livelihoods by the RMC. • Responsible for grievance redress procedure and its functioning and effectiveness of other litigation avoidance measures. • Oversee road safety, erosion, drainage and HIV/AIDS awareness program. • GHA will engage the services of a consultant to assist in GHA's monitoring role to ensure that livelihoods are maintained or restored. • Monitor displaced persons, locate all PAPs, organize follow-up visits and meetings. • Monitor PAPs at half yearly intervals till project closure.
5.	Ghana Health Service	• Change of frequency of diseases. • Occurrences of new diseases in the project catchment areas.

		• Seminar/lectures on HIV/AIDS, STDS and health care and diseases prevention.
6.	ECG	• Public Education and Awareness on power consumption and conservation. • Monitoring of transmission lines and structures (poles) failure • Ensure safety system deployment during project implementation. • Ensure use of standard wiring cables, materials/ components by Contractors.
7.	EPA	• Overall supervision of environmental and social performance of ESMP and Project. • Implementation and monitoring of air quality, noise, waste
8.	Forestry Commission / Ghana Wildlife Society	• Supervision of cutting of trees within and outside the right-of-way for the project • Maintenance of fauna habitat to prevent degradation and decimation of fauna biodiversity.
9.	Projects Organizations Project Community Opinion Leaders/NGOs	• Expression of concerns/issues on environmental protection and sustainability measures enshrined in the PEMP and by the Contractor(s) own PEMP documentation.
10.	GHA Environmental and Social Assessment Unit	• Lead the internal monitoring day-to-day and periodically of ESMP implementation
11.	Policy Planning and Monitoring and Evaluation Units of GHA	• Coordination of internal and external monitoring of ESMP implementation. • Periodic monitoring of the ESMP implementation and its impact
12.	External Consultants or NGOs	• Periodic monitoring, evaluation and auditing of ESMP implementation.
13.	Resettlement Monitoring Committee (RMC)	• Consist of GHA, LVB, EPA and PAPs representatives. • Meet monthly to monitor the effects of resettlement of PAPs. • Responsible for monitoring of resettlement program, including number of PAPs successfully compensated.

Source: KE&T Data Records

8. Estimated Cost of ESMP Implementation

The costs for implementing the ESMP will be part of the overall bills of quantities (BoQ) based on the mitigation measures highlighted in the ESIA and ESMP Reports. In addition, a provisional sum of **USD 6,489,342.38 (excluding contingencies**) has been set aside to finance implementation of the ESMP and complementary initiatives. Furthermore, an estimated **GHc 26,292,463.89** has been earmarked for compensation and resettlement of PAPs. See Table 16.0 for estimated cost of ESMP implementation budget.

Table 16.0 Estimated Environmental and Social Management Plan (ESMP) Budget

Potential Impacts	Mitigation Measures	Specific Objectives	Monitoring Indicators	Implementation Period (Timing)	Responsible Party	Estimated Total Cost (USD)
Survey Works	Limited, localized opening of de-bush line. Limited vegetation cover removal.	Minimization of de-vegetation.	Surveyed line with marked boundaries.	Pre-Construction Period	Contractor	22,712.70
Work Camp & Site Offices	Provision of mobile toilet and sanitary facilities. Daily collection of solid waste. Selection of flat location. Removal of vegetation cover.	Approval from GHA & District/Municipal Assemblies.	Involvement of GHA & District/Municipal Assemblies.	Pre-Construction Period	Contractor	45,425.40
Removal of Trees (Flora Content)	Cutting and removal of limited number of trees. Removal and stockpiling of vegetation cover topsoil. New trees saplings to be promptly planted.	Minimization of de-vegetation	Surveyed area with marked boundaries.	Pre-Construction Period	Contractor	68,138.10
Demolition of Structures	Reuse salvageable materials. Conduct asbestos and lead-based paint survey. Use health and safety controls.	Reduce, recycle, reuse waste materials to minimize landfill load from demolition activities.	Implement Demolition Management Plan.	Pre-Construction Period	Contractor	81,765.71
Air Quality	Fugitive emissions localized. Limited dust generation. Limited site clearance.	De-vegetation limitation.	Implement Vegetation Removal Management Plan.	Pre-Construction Period	Contractor	90,850.79
Human Health and Safety	Use of PPE by workforce. Setup health education programs. Prevent accidents.	Public, Occupational Health and Safety Practice.	Implement Health and Safety Plan (HSP).	Pre-Construction Period	Contractor	145,361.27
Air Quality	Construction vehicles maintenance. Watering of exposed surfaces. Cover vehicles carrying spoil. Install and maintain equipment mufflers.	Dust, fumes and odor nuisance control.	Implement Health and Safety Plan (HSP).	Construction Period	GHA, Contractor, EPA	58,404.08
Soundscape & Vibration	Install sound control devices. Switch-off idling machines. Provide ear plugs to workers. Provide padded seats for equipment operators.	Noise nuisance & vibration effects control.	Implement Health and Safety Plan (HSP).	Construction Period	Contractor, GHA, EPA	116,808.16
Borrow Pits Generation	Access vector ecology in work areas. Employ adequate drainage. Fill methodology to avoid creating mosquito habitats.	Prevent stagnant pool or depressions suited to mosquito breeding.	Implement Construction Environmental & Social Management Plan (CSMP)	Construction Period	Contractor, GHA, EPA, Forestry Commission	175,212.24
Soil Erosion and Sedimentation	No major earthworks during the rainy season. Limited vegetation cover removal. Use adequate drainage structures.	Erosion, siltation and land slip from cuts slopes, grubbing and vegetation removal.	Implement CESMP	Construction Period	Contractor, GHA, EPA	233,616.33
Waste Generation and Removal	Minimize waste generation. Segregate waste for reuse. Provide waste bins. Develop disposal policy.	Excavated spoil, building materials, oil, lubricants and	Implement CESMP	Construction Period	Contactor, GHA, EPA, District &	292,020.41

		domestic waste removal.			Municipal Assemblies.	
Water Quantity and Supplies	Provision of water supplies by contractor. Avoid using project communities water sources.	Water shortage, scarcity shortfall.	Implement CESMP	Construction Period	Contractor, GHA, EPA, GWCL, Water Resources Commission.	350,424.49
Concrete Batch Plant Waste	Reuse concrete products. Prevent dumping of concreate waste. Segregate areas into "clean" and "dirty" sections.	Concrete mixing and resultant contamination.	Implement CESMP	Construction Period	Contractor, GHA, EPA	408,828.57
Construction Camps and Site Offices	Carefully site, construct and manage construction camps. Control erosion and dust. Plan and carry out post-construction site clean-up.	Environmental and social disruption caused by construction camps.	Implement CESMP	Construction Period	Contractor, GHA, EPA, District and Municipal Assemblies.	467,232.65
Loss of Flora and Fauna	Control all clearing activities. Minimize number of trees to be felled. Reduce potential impact of flora and fauna.	Clearing, destruction and decimation of fauna habitat and food resources.	Implement Flora & Fauna Management Plan in CESMP document.	Construction Period	Contractor, GHA, EPA, Forestry Commission.	525,636.73
Traffic and Transportation	Set and enforce speed limits. Regulate transport of toxic materials. Reduce accident risks by safe driving speeds.	Accidents risks associated with vehicular traffic nuisance.	Implement Traffic Management Plan (TMP).	Construction Period	Contractor, GHA, EPA, Motor Traffic Transport Unit (MTTU of Ghana Police Service).	584,040.81
Human Health and Safety	Use of PPE by workforce. Collect and recycle lubricants. Take precaution to avoid accidental spills. Setup health education, HIV/AIDS/STDs/Malaria/Ebola.	Creation of diseases vectors affecting humans, plants and animal's avoidance.	Implement HSP	Construction Period	Contractor, GHA, EPA, MoH, GHS.	642,444.90
Visual Quality and Amenities	Fence in project sites and open spaces to prevent visual intrusion. Water all exposed areas. Ensure that new developments are culturally sound, environmentally and socially appropriate and aesthetically acceptable.	Aesthetic impact of areas development and visually offensive structures removal.	Implement Visual Quality and Amenities Management Plan in CESMP document.	Construction Period.	Contractor, GHA, EPA.	700,848.98
History, Archaeology, Heritage Resources	Assess heritage value of planned sites. Alert Department of Archaeology Heritage Studies (University of Ghana, Legon) on discovery of any object of possible archaeological significance.	Encroachment on previously unidentified cultural heritage sites.	Implement Cultural Heritage Resources Management Plan in CESMP document.	Construction Period.	Contractor, GHA, EPA.	759,253.06
Pedestrian-Vehicular Conflicts	Provision of pedestrian access and walkways. Potential conflict spots will be marked with appropriate road signs. Provision of road signs warning motorists.	Enhance the safety of project residents.	Implement TMP in CESMP document.	Construction Period.	Contarctor, GHA, EPA, MTTU.	58,404.08
Public Utilities and Services	Locate all public utility lines in the RoW.	Impacted public utility lines	Implement Public Utility	Construction Period.	Contractor, GHA, ECG.	116,808.16

	Relocate all public utility lines outside roads project RoW. Engage and consult all public utility line agencies for relocation plans implementation approval.	within RoW relocation.	Lines Relocation Management Plan in CESMP document.		GWCL, Mobile Communication Service Providers.	
Hydrology and Drainage Systems	Diligent execution of earthworks. Create settlement basins or vegetated runoff catchments. Provide oil traps to control leaks and spillage.	Prevention of hydrological and drainage systems from fouling and contamination events.	Implement Hydrology and Drainage System Management Plan in CESMP document.	Construction Period.	Contractor, GHA, EPA, Hydrological Services Department.	58,404.08
Project Communities Access	Meet social concerns of project communities. Provide access for pedestrians, cyclists, motorist and project residents. Provide warning signs for motorists.	Easy facilitation of project resident's access within project corridor.	Implement Project Communities Access Management plan in CESMP document.	Construction Period.	Contractor, GHA, EPA, District and Municipal Assemblies.	116,808.16
Loss of Assets and Compensation Payment	Identify all affected properties in the RoW. Hold consultation and engagement meetings with PAPs. Mark out roads reservation corridor. Payment of compensation monies to PAPs.	Reduction of livelihood and restoration challenges to be faced by PAPs.	Implement Resettlement Action Plan (RAP) Report.	Construction Period.	Contractor, GHA, EPA, LVD, District and Municipal Assemblies.	See RAP Report
Influx Population Surge	Educate workforce on social harmony. Establish positive relation between workers and project residents.	Creation of social disharmony between project residents and imported workforce removal.	Implement Influx Population Surge Management Plan in CESMP document.	Construction Period.	Contractor, GHA, EPA, District and Municipal Assemblies.	116,808.16
Greenhouse Gas (GHG) Emissions	Service construction machinery and equipment regularly. Capture GHG emissions for mobile construction vehicles and stationary equipment.	Reduction in contribution to climate change sources.	Implement GHG Emissions Control Management Plan in CESMP document.	Construction Period.	Contractor, GHA, EPA.	58,404.08
Air and Soundscape Quality	Monitor periodically ambient air and noise quality at designated areas. Provide barriers in front of sensitive receptors. Enforce Ghana EPA guidelines for air and noise emissions.	Traffic flow noise and air pollution monitoring.	Implement CESMP document	Operation Period	GHA, EPA	1,946.80
Borrow Pits generation	Fill up all stagnant pools and ponds. Backfill all excavations. Re-contour areas with stocked up topsoil.	Stagnant pool or depressions suited to mosquito breeding avoidance.	Implement Borrow Pits Reclamation Management Plan in CSMP document.	Operation Period	Contractor, GHA, EPA, District and Municipal Assemblies, Minerals Commission.	25,308.44
Soil Erosion and Sedimentation	Revegetate exposed surfaces. De-silt drains of chocked materials.	Prevent flooding from chocked drainage systems.	Implement Storm and Runoff Management	Operation Period	Contractor, GHA, EPA	3,893.61

	Use silt traps to restrain turn-outs.		Plan in CESMP document.			
Waste Generation and Disposal	Prevent littering of project sites. Prevent unapproved landfill creation. Reduce, reuse and recycle waste materials.	Prevent waste materials build-up leading to disease spread.	Implement Anti-Litter Program and Waste Disposal Plan in CESMP document.	Operation Period	Contractor, GHA, EPA, District and Municipal Assemblies.	5,840.41
Water Quality and Supplies	Test quality of drinking water. Ensure Ghana EPA/WHO regulatory standards.	Prevent contamination of groundwater resources.	Implement Groundwater Resources Management Plan in CESMP document.	Operation Period	Contractor, GHA, EPA, Water Resources Commission.	7,787.21
Concrete Batch Plant Waste	Remove all damaged top soil. Dispose of concrete waste according to approved standards. Re-contour sites to original states.	Prevent concrete mixing resultant contamination of groundwater.	Implement Concrete Waste Management Plan in CESMP document.	Operation Period	Contractor, GHA, EPA	9,734.01
Construction Camps and Site Offices Creation	Complete dismantling and removal camps and offices. Recycle all recyclable materials to deviate waste materials to landfill sites.	Prevent littering of project corridor with camp and site offices abandoned structures.	Implement Construction Camps and Site Offices Decommissioning Plan in CESMP document.	Operation Period	Contractor, GHA, EPA, District and Municipal Assemblies.	13,627.62
Loss of Flora and Fauna	Re-vegetate areas monitored to sustain vegetation community growth.	Prevent destruction and decimation of fauna habitat and food resources.	Implement Weed and Revegetation Management Plan in CESMP document.	Operation Period	Contractor, GHA, EPA, Forestry Commission.	21,414.83
Traffic and Transportation	Minimize impact on flora and fauna during maintenance stage. Monitor traffic flow safety and hazards.	Prevent accidents risks associated with vehicular traffic.	Implement Traffic Flow Monitoring Plan and Roads Safety Campaign Programs.	Operation Period	Contractor, GHA, EPA, National Roads Safety Commission.	9,734.01
Human Health and Safety	Reduce accident rates through improved measures. Minimize risks to project road users.	Prevent creation of diseases vectors affection humans, plants and animals.	Implement Disease Spread Control Surveillance in project communities.	Operation Period	Contractor, GHA, EPA, MoH, GHS.	23,361.63
Visual Quality and Amenities	Trees planting program should be carried out. Remove visually offensive structures and heaps of waste materials.	Prevent aesthetic degradation of roads project corridor.	Implement Trees Replanting Program in CESMP document.	Operation Period	Contractor, EPA, Forestry Commission, NGOs.	9,734.01
History, Archaeology, Heritage Resources	Any 'chance find' from roads expansion program will be documented. Report 'chance find' to Ghana Museums and Monument Board.	Prevent encroachment of previously unidentified cultural heritage sites.	Implement 'Chance Find' Management Plan in CESMP document.	Operation Period	Contractor, EPA, Ghana Museums & Monument Board.	13,627.62
Pedestrian-Vehicle Conflicts	Remove improved roads condition leading to roads side commercial, industrial and settlement developments creating conflicts. Prevent development of social amenities (schools,	Prevent vehicular-pedestrian conflicts.	Implement Pedestrian-Vehicle Conflicts management Plan in CESMP documents.	Operation Period	Contractor, GHA, EPA, District & Municipal Assemblies.	9,734.01

	health centers, churches, mosques, etc.) close to project roads leading to conflicts.					
Public Utilities and Services	Control new developments exacting devastating toll on provision of public utility services. Control urban sprawl emergence due to in-out migration.	Prevent urban sprawl development.	Implement Urban Sprawl Management Plan in CESMP document.	Operation Period	Contractor, GHA, EPA, District & Municipal Assemblies.	3,893.61
Hydrology and Drainage System	Maintenance of grassed or stabilized slopes. Direction of runoffs from roads project away from fertile agricultural lands.	Prevent flooding of low-lying areas and erosion effects.	Implement Hydrology and Drainage Systems Management Plan in CESMP document.	Operation Period	Contractor, EPA, GHA	5,840.41
Project Communities Access	Warn motorists, pedestrians, road user's behavior with traffic control devices. Ensure safe passage to project residents by provision of walkways or sidewalks facilities.	Meet health and safety issues of vulnerable groups (mobility disability).	Implement Vulnerable Groups Access Management Plan in CESMP document.	Operation Period	Contractor, EPA, GHA, NGOs.	9,734.01
Loss of Assets and Compensation Payment	Ensure success of RAP program. Maximize involvement of PAPs during implementation of RAP program. Provide adequate and acceptable compensation payment monies to all PAPs.	Prevent social discontent and upheavals.	Implement RAP Report effectively.	Operation Period	GHA, EPA, RAP Committees, District & Municipal Assemblies.	See RAP Report
Influx Population Surge	Control induced migration incidence. Discourage in-migration of job seekers into project corridor by use of "No Employment" signs – prevent them from camping outside project boundaries.	Prevent temporary camps setup from job seekers within project enclave.	Implement Influx Population Surge Management Plan in CESMP document.	Operation Period	Contractor, GHA, EPA, District & Municipal Assemblies, NGOs.	7,787.21
Greenhouse Gas (GHG) Emissions	Monitor GHG emissions sources within project corridor.	Control GHG emission sources within project enclave.	Implement GHG Management Plan in CESMP document.	Operation Period	GHA, EPA.	5,840.41
Climate Change and Complimentary Initiatives	Selection of appropriate and adequate type of pavement design. Proper design of drainage structures. Proper levels of roads embankment. Provision of dugout and boreholes where appropriate. Roads safety campaign and children's traffic education. Disruption to utilities. HIV/AIDS and Communicable Diseases Awareness and Education. Gender Mainstreaming Plan of Action. Youth Involvement Program.	Climate Change Adaptation and Mitigation Measures. Inclusion of Complimentary Initiatives to enhance the project benefits and participation of local communities.	Implement Climate Change and Complementary Initiatives Plan.	Operation Period	GHA, EPA, District & Municipal Assemblies.	3,893.61

	Landscaping and Trees Planting Program. Resettlement/Compensation (RAP) Payments.					
Gender Issues	Ensure equal opportunities for men and women in line with AfDB Policy on Gender. Provision of ablution corners. Resting place dedicated to women. Consideration of needs of men and women during RAP implementation. Construction of market stalls for women.	Gender sensitization. Increase income levels for men and women through employment during maintenance phases.	Implement Gender Mainstreaming Plan in CESMP document.	Operation Phase	Contractor, GHA, EPA, NGOs, District & Municipal Assemblies.	1,946.80

Sources: KE&T Data Records

9. Implementation Results Schedule and Reporting

The ESMP budget include results matrix, an implementation schedule considering all activities related to the proposed measures (enhancement and mitigation), the monitoring program, consultations, complementary initiatives and institutional arrangements, implementation schedule by phases in consonance with overall project implementation plan. The ESMP implementation schedule has been indicated in Table 60.0 (See Implementation Period (Timing) column). The Project Consultant(s) will prepare monthly and quarterly reports on the implementation of the environmental and social protection measures. In addition, the GHA Project Monitoring Unit will prepare monthly and quarterly reports. The monthly and quarterly reports will be forwarded regularly to the Bank.

10. Conclusion

To ensure compliance with ESMP requirements during the construction and operation periods, an adequate monitoring and evaluation systems have been developed for implementation under the strict supervision of GHA and Ghana EPA in liaison with local NGOs concerned. The Projects will also include special programs for HIV/AIDS Awareness Training, Environmental and Social Protection Training as part of the complementary initiatives.

The potential negative impacts of the project environmental and social requirements during pre-construction, construction and operation phases usually range from low to high significance but controllable. They include: (i) removal of trees/vegetation; air pollution (ii) noise and vibration nuisance (iii) demolition of structures (iv) borrow pits generation (v) erosion and sedimentation (vi) waste generation (vii) water supplies (viii) concrete batch plant and hot mix asphalt/bitumen (ix) construction camps/site offices (x) biodiversity loss (xi) traffic control nuisance (xii) public, occupational health and safety (xiii) visual impairment; (xiv)history, archaeology, heritage resource defacement (xv)resettlement issues (xvi) projects community access (xvii) pedestrian-vehicular conflicts (xviii) influx population surge and (xix) greenhouse gas (GHG) emission. The expectation is that, all the prescribed implementable mitigation and management measures will strongly reduce, eliminate or reverse the negative, non-beneficial impacts.

The beneficial/enhancement issues of the Proposal are positive and significant. They include: (i) human resource development (ii) expansion of GHA roads infrastructure (iii) rural-urban income levels enhancement (iv) improvement in rural-urban economy (v) rural-urban women livelihood improvement

(vi) traffic safety and riding comfort improvement (vii) traffic congestion dissipation (viii) vehicle operation and transport cost reduction. These beneficial/enhancement impacts will ensure that the roads project with the accompanying ESMP will be friendly, environmentally and socially acceptable.

11. Contacts

For further information please contact:

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12. References

- AfDB. 2017 ESMP Summary. Institutional Capacity Building for Improved Access to Water and Sanitation in Port Sudan.
- AfDB. ESIA Summary. Road Construction and Transport Facilitation on the Bamako-Zantiebougou-Boundiali-San Pedro Corridor, Cote D'Ivoire and Mali.
- AfDB. 2015 ESIA Summary. Isebania-KIsii-Ahero Road Rehabilitation, Kenya.
- AfDB. ESMP Summary. Butare-Kitabi-Ntendezi Road, Rwanda.

13. Computation of ESMP Budget

- Estimated Cost of ESMP = Cost of Environmental Mitigation + Cost of Social Mitigation

- Cost of Environmental Mitigation Components consist of the following parameters:

    - ❖ Environmental Engineering Components (drainage, preventing soil erosion, air and water pollution prevention, utilities relocation (telephone lines, water lines, sewage lines, etc.)).
    - ❖ Environmental Amenities Components (pavement/walkways/bicycle routes, landscaping, culture heritage protection, noise barriers through trees planting, environmental measures (stakeholder capacity building, environmental monitoring and follow-up).
- Cost of Environmental Mitigation = Cost of Environmental Engineering Components + Cost Environmental Amenities Components = 3% (Total Design and Construction Project Cost)

- Cost of Social Mitigation Components consist of the following parameters:

    - ❖ Compensation, restoration of livelihoods, HIV/AIDs Awareness Campaign/Ebola/Cholera/Malaria, road safety education, protection of vulnerable populations, control/monitoring of works, audit of road safety, technical audit of works, girlchild education campaign, monitoring and evaluation of the socio-economic impact of the project, support of women's agro-processing activities, support of women paddy rice growers, community capacity building (formation of facility management committees), education of agriculture product storage and preservation (rice growers)

- Cost of Social Mitigation = 2% (Total Design and Construction Project Cost)

- Environmental Mitigation Cost (1):

  - ❖ Section 1: Asutuare Jct. – Volivo Road = USD 42,797,472.46
  - ❖ Section 3: Dufor Adidome – Asikuma Jct. Road = USD 44,682,266.78
  - ❖ **Total (Sections 1&3) = USD 87,479,739.24**

- Environmental Mitigation Cost (2):

  - ❖ Section 2: Asutuare – Aveyime Road = **USD 42,307,108.42**

- **Environmental Mitigation Costs {(1) + (2)} (i.e. Sections 1,3&2) = USD 129,786,847.66**

- Cost of Environmental Mitigation Cost = 3% (Total Design + Construction Project Cost)

  = 0.03x129,786,847.66

  = **3,893,605.43 USD**

- Cost of Social Mitigation = 2% (Total Design + Construction Project Cost)

  = 0.02 x 129,786,847.66

  = **2,595,736.95 USD**

- **Cost of ESMP Implementation (3,893,605.43 + 2,595,736.95) = 6,489,342.38 USD**

Table 17.0 Environmental Engineering Components Cost

Serial Number	Percentage of ESMP Cost (%)	Description of Components	Cost (USD)
1	5.0	Drainage Desilting	97,340.14
2	15.0	Soil Erosion Prevention	292,020.41
3	12.0	Air, Noise & Water Pollution	233,616.33
4	18.0	Utilities Relocation	350,424.49
5	40.0	Landslide, Embankment/Rock Fall, Slide Protection	778,721.09
6	10.0	Contingency	194,680.27
7	**100.0**	**Sub-Total**	**1,946,802.72**

Source: KE&T Data Records

Table 18.0 Environmental Amenities Components Cost

Serial Number	Percentage of ESMP Cost (%)	Description of Components	Cost (USD)
1	20.0	Pavements/Walkways/Bicycle Routes	389,360.54
2	15.0	Landscaping (grassing, beautification)	292,020.41
3	5.0	Cultural Heritage Protection	97,340.14
4	20.0	Noise Barriers (Trees Planting)	389,360.54
5	30.0	Environmental Measures (Stakeholder Capacity Building, Environmental Monitoring Follow-up, Environmental Training)	584,040.81
6	10.0	Contingency	194,680.27
7	**100.0**	**Sub-Total**	**1,946,802.72**

Source: KE&T Data Records

Table 19.0 Social Mitigation Components Cost

Serial Number	Percentage of ESMP Cost (%)	Description of Components	Cost (USD)
1	5.0	HIV/AIDS Awareness Campaign	129,786.85
2	6.0	Road Safety Education (Campaign Population on Road Safety)	155,744.22
3	7.0	Protection of Vulnerable Population	181,701.59
4	8.0	Control/Monitoring of Works	207,658.96
5	9.0	Audit of Road Safety	233,616.33
6	11.0	Technical Audit of Works	285,531.06
7	12.0	Girl-Child Education Campaign	311,488.43
8	13.0	Monitoring and Evaluation of the Socio-Economic Impact of the Project	337,445.80
9	14.0	Support of Women's Agro-Processing Activities	363,403.17
10	5.0	Support of Women Paddy Rice growers	129,786.85
11	5.0	Community Capacity Building (Formation of Facility Management Committees)	129,786.85
12	5.0	Education of Agricultural Product Storage and Preservation (Rice Growers)	129,786.85
13	10.0	Contingency	259,573.70
14	**100.0**	**Sub-Total**	**2,595,736.95**

Source: KE&T Data Records

Table 20.0 Monitoring Program Cost

Serial Number	Percentage of ESMP Cost (%)	Potential Impacts	Cost (USD)
1	13.7	Air	74,497.66
2	12.7	Noise	69,046,61
3	3.0	Soil	16,353.14
4	15.7	Waters	85,399.75
5	5.0	Vegetation and Fauna	27,255.24
6	6.0	Waste Generation and Disposal	32,706.29
7	7.0	Historical, Cultural and Archaeological Resources (Sacred Sites)	38,157.33
8	8.0	Land	43,608.38
9	9.0	Public, Occupational Health and Safety	49,059.43
10	10.0	Road Safety	54,510.45
11	-	Indemnification and Compensation for Loss of Assets	GHc 4,563,154.89
12	9.0	Socio-Economic	49,059.43
13	1.0	Gender	5,451.05
14	**100.0**	**Sub-Total**	**545,104.76**

Source: KE&T Data Records

Table21.0 Gender Component Cost Budget

Serial Number	Description of Component	Cost (USD)	Comments
1	Girl-Child Education Campaign	311,488.43	Extracted from Cost of Social Mitigation Budget
2	Support Women's Agro-Processing Activities	363,403.17	Extracted from Cost of Social Mitigation Budget
3	Support Women Paddy Rice Growers	129,786.85	Extracted from Cost of Social Mitigation Budget
4	**Sub-Total**	**804,678.45**	

Source: KE&T Data Records

Table 22.0 Consultancy Services Component Cost Budget

Serial Number	Description of Component	Cost (USD)	Comments
1	Control and Monitoring of Works	207,658.96	Extracted from Cost of Social Mitigation Budget
2	Audit of Road Safety	233,616.33	Extracted from Cost of Social Mitigation Budget
3	Technical Audit of Works	285,531.06	Extracted from Cost of Social Mitigation Budget
4	Monitoring and Evaluation of Socio-Economic Impact of the Project	337,445.80	Extracted from Cost of Social Mitigation Budget
5	**Sub-Total**	**1,064,252.15**	

Source: KE&T Data Records

Table 23.0 Contingencies Component Cost Budget

Serial Number	Description of Components	Cost (USD)	Comments
1	Environmental Engineering Components	194,680.27	Extracted from Environmental Engineering Component Cost
2	Environmental Amenities Components	194,680.27	Extracted from Environmental Amenities Component Cost
3	Social Mitigation Measures Component	259,573.70	Extracted from Social Mitigation Measures Component Cost
4	**Sub-Total**	**648,934.24**	
5	Institutional Support and Capacity Development Component	194,680.27	30% Contingencies Sub-Total Cost Budget

Source: KE&T Data Records

Table 24.0 Monitoring Program Phasing Cost Budget

Serial Number	Activity Phasing	Percentage of Monitoring Program Cost (%)	Cost (USD)
1	Pre-Construction	7.0	38,157.333
2	Construction	90.0	490,594.284
3	Operation	3.0	16,353.143
4	**Sub-Total**	**100.0**	**545,104.760**

Source: KE&T Data Records

Table 25.0 ESMP Phasing Cost Budget

Serial Number	Activity Phasing	Percentage of ESMP Budget Cost (%)	Cost (USD)
1	Pre-Construction	7.0	454,253.97
2	Construction	90.0	5,840,408.14
3	Operation	3.0	194,680.27
4	**Sub-Total**	**100.0**	**6,489,342.38**

Source: KE&T Data Records

Table 26.0 ESMP Pre-Construction Phase Cost Budget

Serial Number	Description of Activities	Percentage of ESMP Budget Cost (%)	Cost (USD)
1	**Survey Works**	**5.0**	**22,712.70**
2	**Work Camp/Site Offices**	**10.0**	**45,425.40**
3	**Removal of Trees**	**15.0**	**68,138.10**
4	**Demolition of Structures**	**18.0**	**81,765.71**
5	**Air Quality**	**20.0**	**90,850.79**
6	**Human Health**	**32.0**	**145,361.27**
7	**Sub-Total**	**100.0**	**454,253.97**

Source: KE&T Data Records

Table 27.0 ESMP Construction Phase Cost Budget

Serial Number	Description of Activities	Percentage of ESMP Budget Cost (%)	Cost (USD)
1	Air Quality	1.0	58,404.08
2	Soundscape	2.0	116,808.16
3	Borrow Pits	3.0	175,212.24
4	Soil Erosion and Sedimentation	4.0	233,616.33
5	Waste	5.0	292,020.41
6	Water Quantity and Supplies	6.0	350,424.49

7	Concrete Batching Plant Waste	7.0	408,828.57
8	Construction Camps and Site Offices	8.0	467,232.65
9	Loss of Flora and Fauna	9.0	525,636.73
10	Traffic and Transport	10.0	584,040.81
11	Human Health	11.0	642,444.90
12	Visual Quality	12.0	700.848.98
13	History, Culture and Archaeological Resources	13.0	759,253.06
14	Pedestrian-Vehicular Conflicts	1.0	58,404.08
15	Public Utilities	2.0	116,808.16
16	Hydrology and Drainage	1.0	58,404,08
17	Project Communities Access	2.0	116,808.16
18	Influx Population Surge	2.0	116,808.16
19	GHG Emissions	1.0	58,404.08
20	**Sub-Total**	**100.0**	**5,840,408.14**

Source: KE&T Data Records

Table 28.0 ESMP Operation Phase Cost Budget

Serial Number	Description of Activities	Percentage of ESMP Budget Cost (%)	Cost (USD)
1	Air Quality and Soundscape	1.0	1,946.80
2	Borrow Pits	13.0	25,308.44
3	Soil Erosion and Sedimentation	2.0	3,893.61
4	Waste	3.0	5,840.41
5	Water Quantity and Supplies	4.0	7,787.21
6	Concrete Batching Plant Waste	5.0	9,734.01
7	Construction Camps and Site Offices	7.0	13,627.62
8	Loss of Flora and Fauna	11.0	21,414.83
9	Traffic and Transport	5.0	9,734.01
10	Human Health	12.0	23,361.63
11	Visual Quality	5.0	9,734.01
12	History, Culture and Archaeological Resources	7.0	13,627.62

13	Pedestrian-Vehicular Conflicts	5.0	9,734.01
14	Public Utilities	2.0	3,893.61
15	Hydrology and Drainage	3.0	5,840.41
16	Project Communities Access	5.0	9,734.01
17	Influx Population Surge	4.0	7,787.21
18	GHG Emissions	3.0	5,840.41
19	Climate Change and Complementary Initiatives	2.0	3,893.61
20	Gender Issues	1.0	1,946.80
21	**Sub-Total**	**100.0**	**194,680.27**

Source: KE&T Data Records