MINISTRY OF ROADS AND HIGHWAYS (MRH)
REPUBLIC OF GHANA

PREPARATORY SURVEY
ON
EASTERN CORRIDOR DEVELOPMENT PROJECT
IN
THE REPUBLIC OF GHANA

FINAL REPORT

JANUARY 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CENTRAL CONSULTANT INC.
PADECO CO., LTD.

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October 2012

PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the Preparatory Survey on Eastern Corridor Development Project in the Republic of Ghana and entrusted the study to Central Consultant Inc. and PADECO Co., Ltd..

The team held discussions with officials of the Government of the Republic of Ghana and conducted a feasibility study on the construction of the Eastern Corridor from March to October 2012. After returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will promote the project and enhance friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Ghana for their tremendous cooperation with the study.

January 2013

Kazunori MIURA
Director General
Economic Infrastructure Department
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

January 2013

Mr. Kazunori MIURA
Director General
Economic Infrastructure Department
Japan International Cooperation Agency

Dear Sir,

We are pleased to submit herewith the final report on the Preparatory Survey on Eastern Corridor Development Project in the Republic of Ghana.

This study was conducted by Central Consultant Inc. in association with PADECO Co. Ltd. between March and October 2012 in Ghana. During the course of the study, we examined the present condition of the road network in Ghana and conducted a feasibility study on the construction of a part of the Eastern Corridor between Asutsuare Junction and Asikuma Junction, including a bridge across the Volta River, and upgrading of the Asutsuare – Aveyime road.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of the Japan International Cooperation Agency and the Embassy of Japan in the Republic of Ghana. We would also like to thank to the officials concerned of the Ministry of Roads and Highways (MRH), the Ghana Highway Authority (GHA) and other relevant authorities in the Government of the Republic of Ghana.

We hope this study will assist the development of the Eastern Corridor in the Republic of Ghana.

Yours faithfully

H. Nishimura

Hikaru NISHIMURA
Team Leader
Preparatory Survey on Eastern Corridor Development
Project in the Republic of Ghana

Bird’s Eye View of the New Bridge across the Volta River

Eye Level View of the New Bridge across the Volta River

SUMMARY

SUMMARY

1. Introduction

(1) Background of the Study

The Government of Ghana (GoG) puts high priority on developing the Eastern Corridor in the eastern area of the country under the Road Sector Medium-Term Development Plan and is actively promoting road development. Development of the Eastern Corridor is expected to contribute to economic revitalization and poverty alleviation in the area along the corridor and neighbouring countries by reducing traffic congestion and facilitating international logistics.

Based on a request from the GoG regarding support for the targeted section of the Eastern Corridor development project, the Ministry of Roads and Highways (MRH), Ghana Highway Authority (GHA) and Japan International Cooperation Agency (JICA) have discussed the project by dispatching a JICA mission for the preparatory survey of the project. As a result of the series of discussions, the Ghanaian side and JICA's mission agreed to carry out a preparatory study to confirm the feasibility of the project.

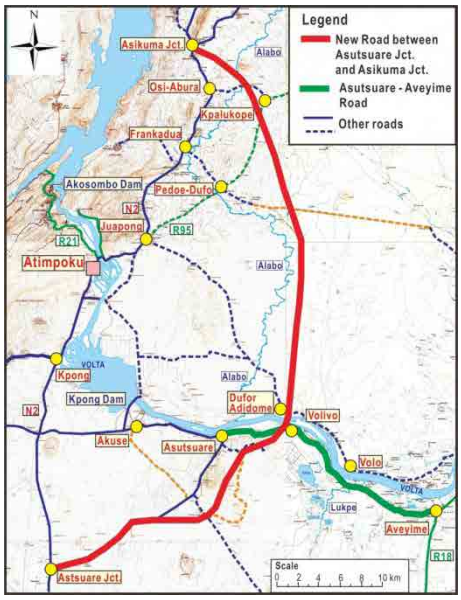
(2) Objectives of the Study

The objectives of the study are as follows (see Figure-1):

- To select the optimum route, with a new bridge across the Volta River, among alternative routes between Asutsuare Junction (Jct.) and Asikuma Jct. on the Eastern Corridor (N2), and to confirm the viability of the road and bridge development project.
- To confirm the viability of the road development project between Aveyime and Asutsuare.

(3) Study Area

The Study Area is in the Volta, Eastern and Greater Accra Regions. Even though the project roads are located between Asutsuare Jct. and Asikuma Jct., and Asutsuare and Aveyime, the Study Area covers a larger area in those three regions in terms of transport planning.



Source: Study Team

Figure-1 Project Roads for F/S

(4) Scope of the Study

The Study Team has completed the following work items since commencement of the Study in March 2012.

- Preparatory Works
- Study of Basic Site Conditions
- Preliminary Design and Evaluation of Project
- Preparation of Final Report

(5) Study Organisation

The Study has been carried out in close collaboration with related officials and counterpart personnel of the GHA.

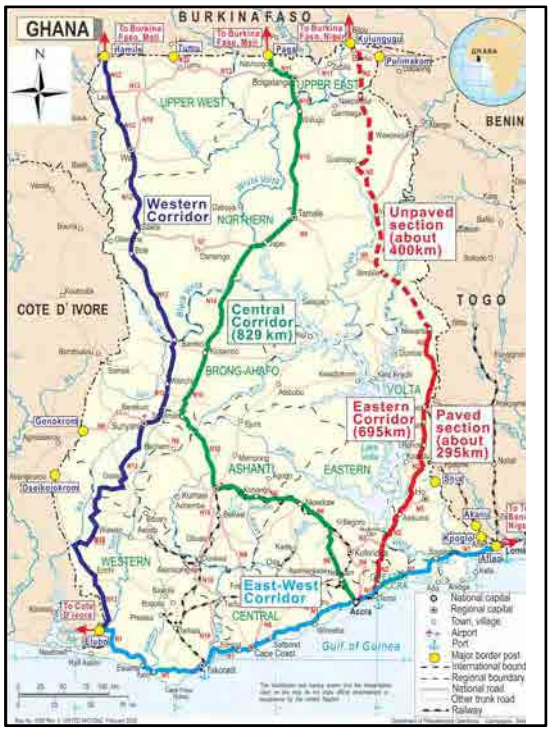
2. Outline of the Study Area

(1) Definition of the Eastern Corridor

The Eastern Corridor is defined as National Road N2 connecting Tema Port and the Kulungugu Border Post (BP) with Burkina Faso. The length of the Eastern Corridor is 695 km, of which about 400 km is unpaved road.

(2) Regional Coordination Programme

In the Western Africa region, there is regional coordination by the Economic Community of West African States (ECOWAS). The ECOWAS Treaty was adopted by 18 countries in 1975 and revised in 1991. The revised Treaty defines the coordination programme for the transport, communications and tourism sectors..



Source: Study Team

Figure-2 Major Transport Corridors and Border Posts

(3) Socio-economic Conditions in the Study Area

a) Land Use in the Study Area

- Land use in the Study Area is mainly agricultural, consisting of the Accra Plain with widespread cultivation of paddy, maize, oil palm, banana, cassava and yam.
- In the southern part of the Volta River, medium- and large-scale paddy fields are cultivated and a large-scale banana plantation is in operation, using the irrigation scheme from the Kpong Dam reservoir which was constructed in 1980s.
- Large agricultural development projects are underway in the north-western part of the Volta River and private companies are planning to cultivate vegetables and maize. However, there is no medium- or large-scale cultivation in the north-eastern part of the

Source: Study Team

Figure-3 Land Use in the Study Area

Volta River, since there are neither access roads to transport products nor irrigation schemes.

- There is small-scale rain-fed cultivation of cassava, maize, oil palm and mango on the north side of the Alabo River.

b) Demography

- The Study Area consists of three districts in the Eastern Region, two districts in the Greater Accra Region and four districts in the Volta Region and Table-1 shows the population by district in the Study Area. Note that the actual population in the Study Area is less than the total population shown in this table, as the Study Area covers only part of each district.
- Table-2 shows the poverty headcount ratio in Ghana for 1991, 1997, and 2006. Ghana has achieved reductions of about 26 points and 23 points in the poverty headcount ratio at US$2 a day and US$1.25 a day, respectively.

Table-1 Population by District in the Study Area

Region	District	Population	
		2000	2010
Eastern	Yilo Krobo	86,043	106,028
	Manya Krobo	154,301	190,140
	Asuogyaman	75,920	93,554
Greater Accra	Dangme West	96,809	130,260
	Dangme East	93,112	125,286
Volta	South Tongu	64,811	83,217
	North Tongu	130,388	167,418
	Adaku-Anygbe	51,409	66,009
	Ho	183,922	236,155
Total		938,715	1,200,077

Source: Estimated by the Study Team based on 2010 population and housing census, Provisional Report, GSS

Table-2 Poverty Headcount Ratio in Ghana

(Unit: % of population)

Poverty Headcount Ratio	1991	1997	2006
Poverty headcount ratio at US$2 a day (PPP)	77.65	63.34	51.84
Poverty headcount ratio at US$1.25 a day (PPP)	51.07	39.12	28.59

Source: Compiled by the Study Team using WB databank, April 2012

(4) Economic Conditions in Ghana and Neighbouring Countries

a) GDP

The service sector is almost 50% of the share of the Gross Domestic Product (GDP), followed by the agriculture sector (26.7% in 2006) and industry sector (20.6% in 2006). The GDP growth rate in constant price of 2006 was lowered between 2008 and 2009, but recovered again in 2010[1].

Comparison of the GDP per capita and the fluctuation of GDP growth rate in Ghana and neighbouring countries show that the GDP per capita has been highest in Ghana (US$ 1,283 in 2010), however, the GDP growth rate was third. Since crude oil exploration started in December 2010, real GDP growth is projected by 13.8%, 8.8%, 7.4% and 5.7% in 2011, 2012, 2013 and 2017, respectively[2].

b) Foreign Direct Investment

Foreign direct investment into Ghana is predominant (US$ 2,527 million in 2010)[3] compared with neighbouring countries, mainly because of foreign investments in the mineral and agricultural sectors.

[1] Quarterly Gross Domestic Product, Second quarter 2011, October 2011, Ghana Statistical Service

[2] Compiled by the Study Team using WB databank, http://data.worldbank.org/country, April 2012

[3] Compiled by the Study Team using WB databank, http://data.worldbank.org/country, April 2012

c) External Trade

- Even though exports increased up to 2010, the trade balance remains negative.
- Gold and cocoa beans are major export commodities with share of 70.6% in 2008[4]. As the second largest producer of gold in Africa and second largest exporter of cocoa beans in the world[5], those export products greatly contribute to export earnings in Ghana, even though their shares in GDP are limited.
- Not like export commodities, there is no predominant import commodities, as the leading commodity petroleum oil and crude occupy on 12.7% of total import commodities.

d) Agriculture

- Agriculture is the most important economic sector, employing more than half of the population and accounting for almost 27% of GDP and 34% of export earnings.
- Production of all crops, except cocoyam, has been increasing an average annual 5.1%, reaching almost 28 million metric tonnes (MT) and production of rice is increasing the fastest at 8.6%., followed by maize and plantain[6].
- The three regions which form the Study Area accounted for 39.3% of cassava, 27.7% of maize, 25.3% of both cocoyam and plantain, and 25.1% of rice. This means that these three regions are very important for the production of major crops in the whole country.
- Although the net deficit/surplus of each type of commodity, i.e., cereals, starchy staples and legumes, is a surplus in total, there is a shortage of milled rice and wheat, even though large quantities are imported. Since rice and bread have become staple foods in addition to the traditional starchy staple foods, the production of rice, which is cultivated in Ghana, needs to be increased in order to minimise the import deficit.
- Cocoa is a traditional export-oriented crop of Ghana, with the sixth-largest global share of 5.4%, contributing to 27.2% of export earnings in 2010. In addition, production of oil palm, both by large-scale plantation and smallholder cultivation, has been increasing, however, oil palm products are mainly consumed in Ghana and neighbouring countries.
- Even though the export value of each commodity varies, exports of banana, vegetables and cashew nuts have continuously increased.

e) Fishery

The production of both marine and inland sources has been decreasing and the majority of fish caught in the sea (mainly tuna) are exported. Instead, cultivation of tilapia using surface water of the Volta Lake and the Volta River has become very popular in Asuogyaman and South Dayi. Tilapia cultivation in these two districts is expected to continue increasing, because of the better quality of water and sufficient surface area for cultivation on the Volta River.

f) Forestry

The forestry sector accounted for 3.1% of GDP in 2010, and exports of woods and plywood were

[4] 2010 International Trade Statistics Yearbook", UN Comtrade, http://comtrade.un.org/pb/

[5] International Cocoa Organization

[6] Statistics, Research and Info. Directorate (SRID), MoFA, January, 2012

the third and fourth largest export earners in 2008, respectively.

g) Mining

- The mining industry is one of the most important sectors for export earnings, with gold alone accounting for 45% of total exports and over 90% of mineral exports, even though the mining sector accounts for only about 2.6% of GDP. Other than gold, Ghana is also a major producer of bauxite, manganese and diamonds, however, bauxite is still exported as ore; without smelting to alumina.
- More than 90% of gold production comes from underground mines in the Western and Ashanti Regions, with the remainder coming from river beds in the Ashanti Region and Central Regions.

(5) Natural Conditions in the Study Area

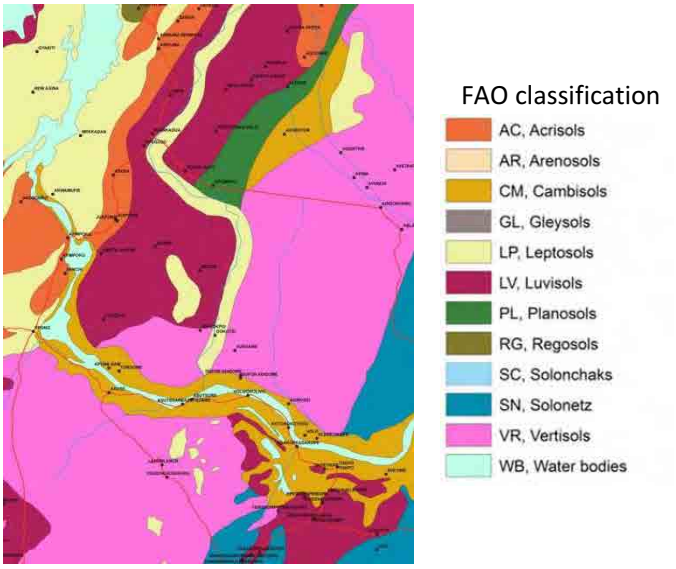
a) Topographical Conditions and Soil

The Study Area lies mainly on the Accra Plains, which are flat and featureless, and descend gradually to the Gulf of Guinea along the Volta River. The hills and slopes in this area are also suitable lands for cultivation.

b) Soil Conditions in the Study Area

The Soil Research Institute under the Ministry of Environment, Science and Technology (MEST) has prepared a soil condition map covering the whole country of Ghana and Figure-2 shows the FAO soil classification in the Study Area.

According to this FAO Soil Classification, the Cambisols layer is mainly located along the Volta River from the Akosombo Dam, while the Luvisols and Vertisols layers are located behind the Cambisol layer. The Arensols layer and Vertisols layers are highly suitable soil for cultivation, however, the Vertisols layer has also called as black cotton soil[7].



Source: Soil Research Institute

Figure-4 FAO Soil Classification Map of the Study Area

c) Hydrological Conditions

- The Volta River Basin is the largest single catchment and drains nearly 70% of Ghana, in addition to Burkina Faso in the North, Côte d'Ivoire in the West and Togo in the East.
- The Akosombo Hydroelectric Dam was constructed in 1965 and it created Lake Volta which is the world's largest man-made lake, covering 8,502 km^2, which is 3.6% of Ghana's land area.

[7] The Vertisols layer suitable for cultivation of crops, such as maize, rice, sorghum and vegetable when irrigation is available. The Vertisols layer is also called as the black cotton soil, and the shrinking and swelling of Vertisols can damage roads, leading to extensive subsidence.

- The Volta River Authority (VRA) constructed the second largest hydroelectric dam, Kpong Hydroelectric Dam, downstream of the Akosombo Hydroelectric Dam in 1982. The Kpong Dam is also used as the source of irrigation schemes for both sides of the Volta River.
- The main hydrological source in the Study Area is the lower stream of the Volta River from the Kpong Hydroelectric Dam. The water flow of this lower stream is totally controlled by the Kpong Hydroelectric Dam, with a normal discharge volume of 1,500 m^3/sec. and emergency discharge of 3,000 m^3/sec. Besides the Volta River, the Alabo River, which originate in the mountain range near Ho and has a catchment area of 678 km^2, flows into the Volta River near Dufor Adidome.

d) Meteorological Conditions

There are two rainy seasons in the Study Area, starts in April and ends in July, and start again in September and ends in October. Thus, it is necessary to consider these two rainy seasons for earth works of road construction and construction of substructure of bridges.

(6) Existing Development Programmes

a) National Development Plan

The current national development plan is Ghana Shared Growth Development Agenda (GSGDA) 2010–2013. The Study Team has referred the recent annual report of GSGDA, which was published in August 2011 to understand the overall development of Ghana relevant to the Eastern Corridor Development. The Study Team examined the relationship between the impacts generated by improving the corridor and the items related to agriculture and infrastructure development in the GSGDA. In the GSGDA, the key issue for agricultural development is “Accelerated Agricultural Modernisation and Sustainable Natural Resource Management”. At the same time, the key issue for infrastructure development is “Infrastructure, Energy and Human Settlement Development”.

b) Regional Development Plan

The information in the Medium Term Development Plan (MTDP) including GSGDA is followed by the Regional Development Plan (RDP) administered by the Regional Coordinating Council (RCC) of ten regional offices respectively. The RDP is a set of combined reports of the MTDP administered by the Municipal and District Assembly of each district. The MTDP is issued once every three years.

(7) Potential of Growth Sectors in the Study Area

a) Agricultural Sector

The Food and Agriculture Sector Development Policy (FASDEP) was developed by the GoG in 2002 to guide development and interventions in the agricultural sector. The second plan, FASDEP II, which was launched in 2007 and seeks to enhance the environment for all categories of farmers, while targeting poor, risk-prone and risk-averse producers.

Through activities including site investigation and interviews with the various organisations by the Study Team, agricultural development projects in the Study Area have been identified as shown in Figure-4.

There is about 25,000 ha. of arable land on this Vertisols soil, which is currently not fully used for

cultivation due to lack of access road to transport agricultural product. As most of new agricultural development on the northern side of the Volta River are carried out on land of Vertisols soil, there is great potential for the development of this 25,000 ha. of arable land, if direct access road to the big market is constructed.

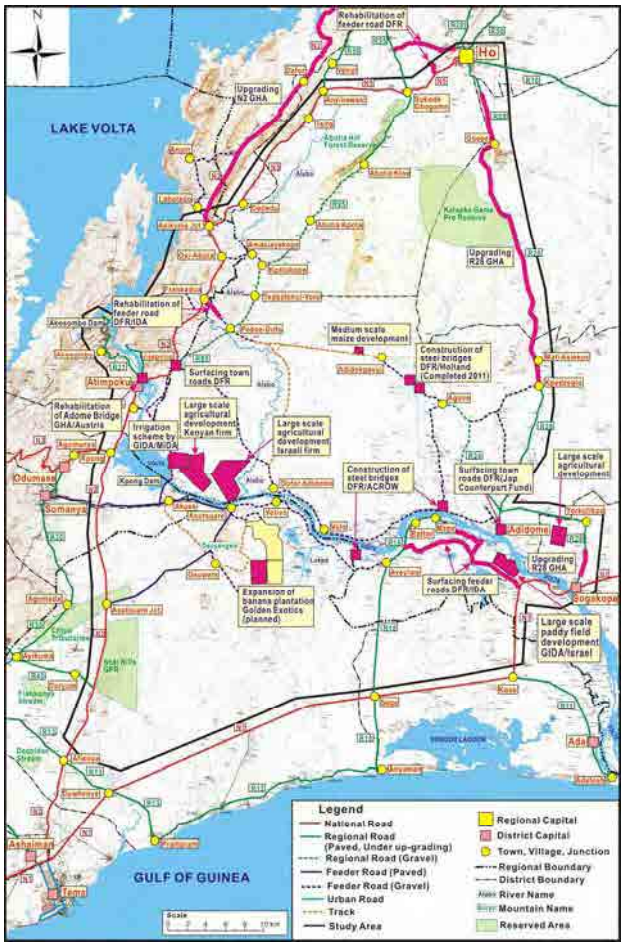
b) Mining Sector

The major mineral resources are gold, diamonds, manganese and bauxite in Ghana.

According to the mineral occurrence map, the eastern belt of acidic gneiss consists mainly of the grained metamorphosed rocks rather richer in minerals than the rocks in the western belt and with many fewer quartz veins. The major mining deposits in the Study Area mostly lie along the Volta River, however, there is no mineral deposit of commercial and economic value except for clay, granite for aggregates, oyster shell, feldspar, Nepheline Gneiss, and sand.

c) Tourism Sector

The tourism sector is one of the primary industries contributing to national income. The National Tourism Development Policy and Structural Plan provides the framework for developing integrated and sustainable tourism over the long term in Ghana.



Source: Study Team

Figure-5 Agricultural Development Projects in the Study Area

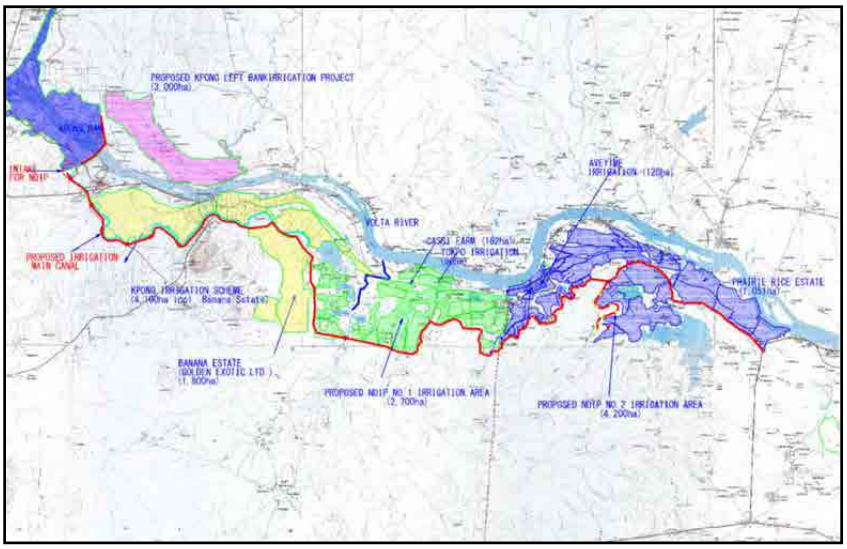
Although there are various tourism resources in the Study Area, many tourist attractions remain undeveloped due to lack of access roads to the tourism sites. Construction of a new road section between Asutsuare Jct. and Asikuma Jct. will bring opportunities to accelerate the tourist industry in the Study Area, including promoting eco-tourism. The planned bridge over the Volta River would itself be a new tourist attraction, providing a dynamic and harmonised landscape of the bridge structure over the river and the Osuyongwa Mountains. This may lead to the development of resort hotels along the Volta River similar to those at the Lower Volta Bridge in Sogakope and Adomi Bridge in Atimpoku.

(8) Major Development Projects in the Study Area

- Agricultural development along the Volta River started in 1982 with the Kpong Irrigation Scheme (KIS) executed by the Ghana Irrigation Development Authority (GIDA), which

provides irrigation water to 3,113 ha. of cultivated land, including 1,200 ha. of banana estate operated by Golden Exotic Ltd.

- JICA conducted a pre-feasibility study to develop the gravity irrigation development plan to achieve double cropping of irrigated rice, the so-called Accra Plains Gravity Irrigation Project (APGIP), and completed the study in May 2011. The basic concept of the APGIP is to upgrade the existing KIS and extend the irrigation canal up to N1. The planned area east of the KIS is defined as the New Development Irrigation Scheme (NDIS). The planned irrigated area by the APGIP is 4,100 ha for the expanded KIS area and 6,900 ha for NDIS, as shown in Figure-6. One of the largest agricultural developments in this irrigation project is located in Aveyime in the North Tongu District, known as the Aveyime Irrigation Scheme.



Source: GIDA

Figure-6 Outline of the Accra Plain Gravity Irrigation Project

- The GIDA is implementing the Kpong Left Bank Irrigation Project (KLBIP), with financial assistance of the MCC, and jointly working with a Kenyan company VEGPRO under a Public Private Partnership (PPP) scheme. The total area of the project is 3,000 ha, of which the GIDA covers 450 ha. VEGPRO is going to cultivate baby corn and chilli exclusively for export to the UK.
- On the eastern side of the KLBIP, an Israeli company, PE-AVIV, has already started an agricultural development scheme with 5,000 ha of land. PE-AVIV has developed a pumping irrigation system, and are going to cultivate maize and vegetables, initially for domestic consumption.
- Currently there are three Small Scale Irrigation Schemes (SSIS) underway in North Tong District. These projects stared in only recently compared to those by the KLBIP, and are still underway.
- Golden Exotic Ltd., which operates 1,200 ha of banana estate, plans to add 600 ha. of estate on the south-western side adjacent to their existing estate. Their products are exclusively exported to the UK and France. According to Golden Exotic Ltd. they are also interested in expanding their estate on the eastern side of the Alabo River on the left bank of the Volta River.

- On the eastern edge of APGIP, an Israeli company has already started to develop the Prairie Rice Estate with 1,051 ha of land. Another paddy field development is underway near Yorkutikpo township along the R28 Sugakope – Ho road.

3. Present Situation of the Transport System in the Study Area

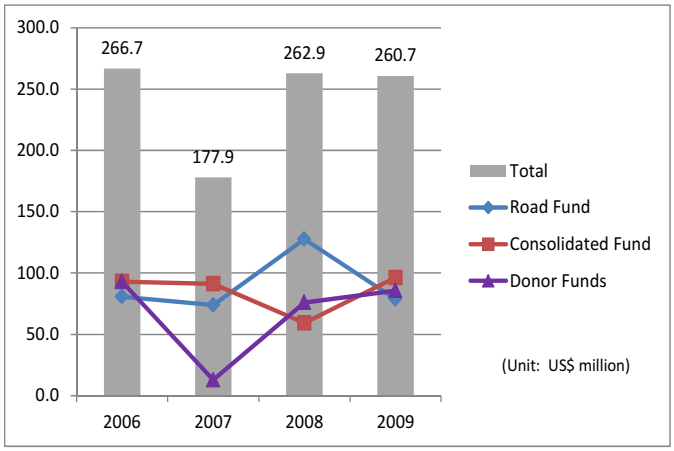
(1) Present Situation of the Road Sub-sector

a) Policy and Programmes of the Road Sub-sector

- The National Transport Policy (NTP) was prepared as a transport infrastructure sector study to reach the goal of the Growth and Poverty Reduction Strategy (GPRS II), and is Ghana's first comprehensive national transport policy. Priorities in the transport infrastructure policy have been decided based on short-term imperatives, resulting in disharmonized development. For example, 99% of the budget for infrastructure including the road fund has been allocated to the road sub-sector for rapidly extending the road network.
- The Transport Sector Development Programme (TSDP) is an integrated programme of development activities to attain the goals of the NTP. The activity programmes are described with financial projections for the period 2008–2012. The estimated total for the five years is US$ 4,821 million, of which the road sub-sector accounts for 65% (US$ 3,112 million). Trunk roads, which are under the GHA, account for 62% of the road sub-sector (US$ 1,860 million) in estimated total for the five years.
- The Sector Medium-Term Development Plan (SMTDP) (2010–2013) is a medium-term development plan for the road sub-sector. SMTDP 2010–2013, which was issued in 2011, is used for allocating budget during 2012. Each SMTDP includes details such as development priorities, development programmes, and financial requirements.

b) Present Situation of Road-sub-sector

- The length of the road networks in Ghana rose from 37,321 km in 2000 to 67,448 km in 2008. There was a particularly large increase in the lengths of feeder roads and urban roads. The GHA manages the trunk road networks, consists of national roads, inter-regional roads and regional roads.
- 30 to 50% of the road network is not maintained every year. The Study found that some roads have not been maintained for over three years.
- The source of funding for managing the road network is separated into three funds: Road Fund (RF), Consolidated Fund, and Development Partner's Fund. Figure-7 illustrates the changes in disbursement from the three funds from 2006 to 2009.



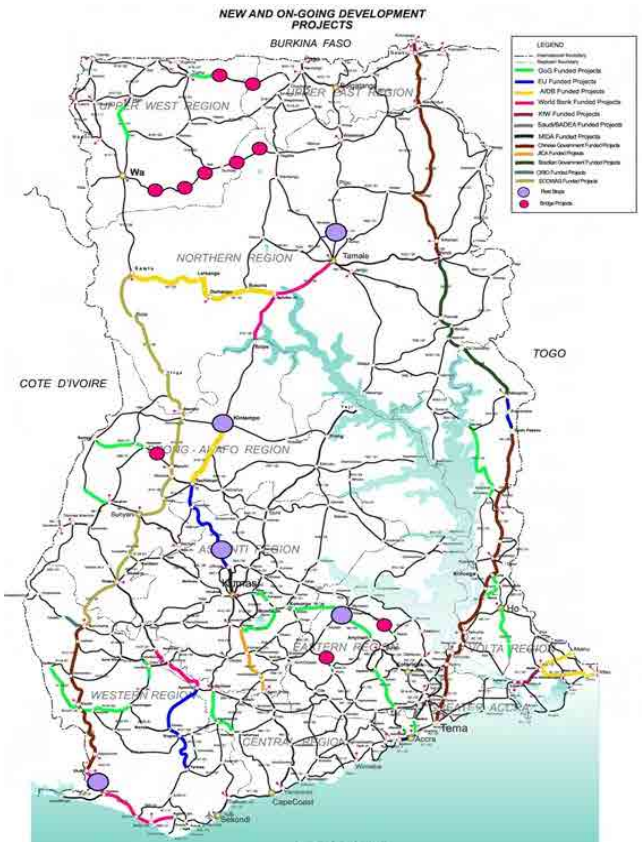
Source: Study Team based on SMTDP, 2010–2013, MRH

Figure-7 Changes in Disbursement from the Three Funds

- Paved roads of GHA roadnetwork account for 49%, and the road network is composed of good roads (34%), fair roads (28%), and poor road (38%) as of Feburary 2012.
- The location of ongoing and new projects under the GHA are illustrated in Figure-8.

c) Present Situation of the Road Network in the Study Area

- There are four national roads: N1 connecting Tema roundabout and Sogakope, and N2 connecting Tema roundabout and Asikuma Jct., N3 connecting Kpong and Koforidua, and N5 connecting Asikuma Jct. and Ho.



Source: GHA

Figure-8 Ongoing Projects under the GHA

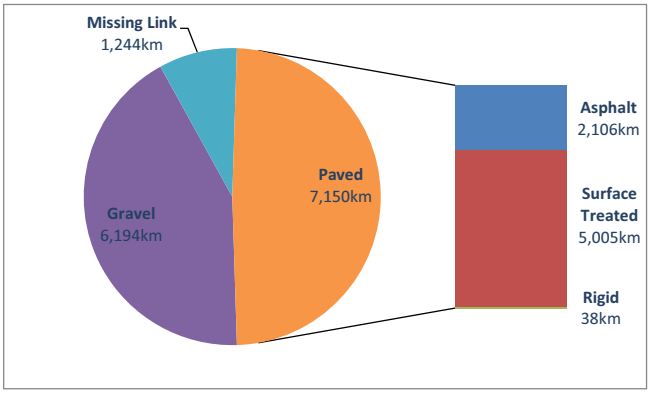
Source: GHA

Figure-9 Road Network in the Study Area

- There are four regional roads in the Study Area: R18 connecting Sege on N1 and Mepe via Aveyime and Battor, R28 connecting Sogakope and Ho via Adidome, R24 connecting Adidome and Agove, and R95 connecting Juapong and Sokode Gbogame.
- The GHA plans to change the classification of the Somanya – Akuse – Asutsuare – Aveyime – N1 road into an inter-regional road when the the whole section has been upgraded to the inter-regional road standard.
- There are a number of feeder roads in the Study Area: some of them are gravel roads (engineered road by Department of Feeder Road (DFR) classification), while many of them are tracks without any physical work.

d) Results of Road Inventory Survey by the GHA

- The GHA managed 14,588 km of road network as of 2011, including missing links (1,244 km), which are impassable during the rainy season. Some 38% of the road network is "Poor", which is far different from the target figure of below 10% by 2015.
- By surface type, the GHA's road network is composed of 7,150 km of paved road (49%) and 6,194 km of gravel road (42%). Paved roads are further classified into three types: asphalt concrete (flexible pavement), surface treated, and cement concrete (rigid pavement), of which surface treated accounts for the majority (see Figure-10).



Source: Study Team based on Road Condition Report, Year 2011

Figure-10 Breakdown of Road Types under the GHA

e) Major Findings and Problems of the Road Sub-sector

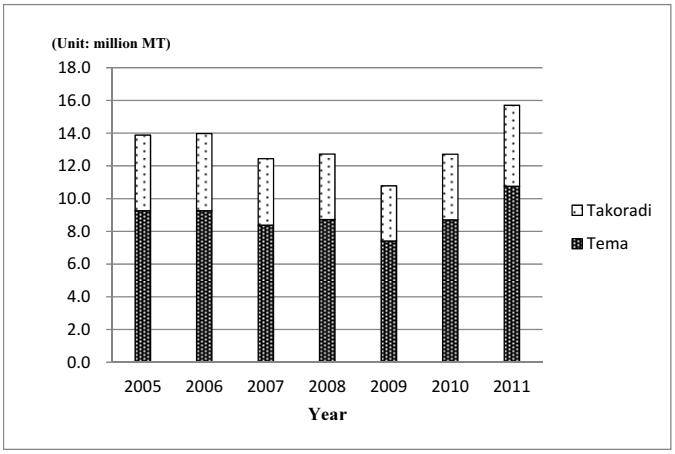
- Budget allocation to the road sub-sector is shrinking compared with other transport sectors. In the road sub-sector, the budget for development works in particular is falling, although its share remains high.
- Capacity building for municipality and district personnel cannot keep pace with the expansion of the road networks.
- Globalisation increases competition with surrounding countries. The first goal of the NTP is to establish Ghana as a transportation hub for the West African sub-region.
- Construction costs are increasing in accordance with inflation. However, there is little investment in construction machinery and facilities, and such equipment is generally imported.
- Traffic congestion remains terrible, partly because 95% of passengers use the road network. Traffic congestion hinders haulage to distant areas.
- Compared with the increase of the road network, the budget for maintenance works, which mainly comes from the RF, has not increased sufficiently. A lack of maintenance can lead to potholes on the pavement within one year, and cause the pavement to come away from the road.

(2) Present Situation of Maritime and Inland Waterway Transport Sub-sector

a) Maritime Transport

- The organisations in charge of managing the maritime and inland transport sub-sector are the Ghana Maritime Authority (GMA), Ghana Shippers authority, Ghana Ports and Harbours Authority (GPHA) and Volta Lake Transport Company (VLTC).

- Figure-11 shows the total cargo throughput for Tema and Takoradi Ports. The total cargo throughput in both ports showed an increase from 2005 to 2011, despite a decline in 2009. The total cargo throughput in 2005 was 13.9 million MT which increased to 15.7 million MT in 2011 posting an average annual growth rate of 2.1%.



Source: GPHA

Figure-11 Total Cargo Throughput for Tema Port and Takoradi Port

- The cargo throughput for Tema Port fluctuated between 2005 and 2011, but increased from 9.2 million MT in 2005 to 10.7 million MT in 2011. The highest import and export volumes of 9.2 million MT and 1.6 million MT were achieved by Tema Port in 2011. The average annual growth rate for imports was 2.9% whereas exports were almost same between 2005 and 2011 by both ports.
- The volume of transit cargo declined from 2005 to 2011. 2011 recorded 0.6 million MT compared to 1.1 million MT in 2005, an annual decline of -8.8%.
- The total container traffic for both ports grew from 442,082 Twenty-feet Equivalent Units (TEUs) in 2005 to 813,494 TEUs in 2011, with the average annual growth rate of 10.7%.
- The turnaround time has been above 100 hours (about 4 days) at Tema Port. As indicated in the GPHA Performance Contract (2010), "the reason for the relatively high turn-around time at Tema Port includes the inadequacy of deep-draft berths that invariably leads to high waiting times of these vessels".
- The traffic volume for both ports depends to a large degree on the volume of Ghanaian trade, which is a direct reflection of economic activity in the country. Trading patterns of some landlocked countries have also influenced the traffic volumes of ports in Ghana: in particular, severe competition with Lome Port in Togo (free port) has influenced transit traffic volume.

b) Inland Waterway Transport (Lake Volta Transport)

The total cargo throughput handled by VLTC in 2009 was 83,145 MT. The main categories of cargo recorded were liquid: 13,306 MT (16.0%); cement: 57,045 MT (68.6%); foodstuffs: 6,919 MT (8.3%) and others: 5,875 MT (7.1%) The significant drop in the liquid cargo from 2005 to 2009 was due to VLTC's inability to obtain the promised cargo volume from the bulk cargo clients.

(3) Present Situation of Railway Sub-sector

- The total route length of Ghana's railway network, which is 1,000 mm gauge, is 947 km. The shift in policy in the railway sub-sector has created the Ghana Railway Development Authority (GRDA) and leaves the GRCL as an operator. The development and maintenance of railway assets is not the responsibility of the GRDA.

- The weak performance in the railway operation from 2005 to 2009 was demonstrated by the steady decline year on year in the annual freight gross tonne-km. The annual railway freight tonne-km consistently declined from 224 million in 2005 to 26 million in 2009.
- The interventions in early 2009 to boost railway transportation have paid off and ceased operation of most of railway services for the rehabilitation works. Some the major interventions are modernization of the railway lines between Accra–Tema, Accra–Nsawam, Takoradi–Kumasi and Dunkwa–Awaso Line, and refurbishing of rolling stock. Rehabilitation of the Takoradi–Kumasi line will result in a dry port being built in Boankra on the Accra – Kumasi Road (N6). This rehabilitation project is being implemented with a US$ 3 billion loan from the Government of China.

(4) Air Transport Sub-sector

- Air transportation continues to play a very significant and integral role in the transport sector for the movement of passengers and freight, especially in Ghana's external trade. Domestic air transportation is also steadily being used. Air transportation is important for mobility in the modern business world and therefore in recent times, the GoG has implemented a number of policies of expanding the civil aviation industry.
- From 2005 to 2009, the domestic passenger throughput increased by an average of 27.0% annually. From a passenger throughput of 32,950 in 2006, it increased significantly to 132,087 in 2008, and then declined by 7.6% to 122,059 in 2009.

4. Future Traffic Demand Forecast

(1) Results of Traffic Surveys

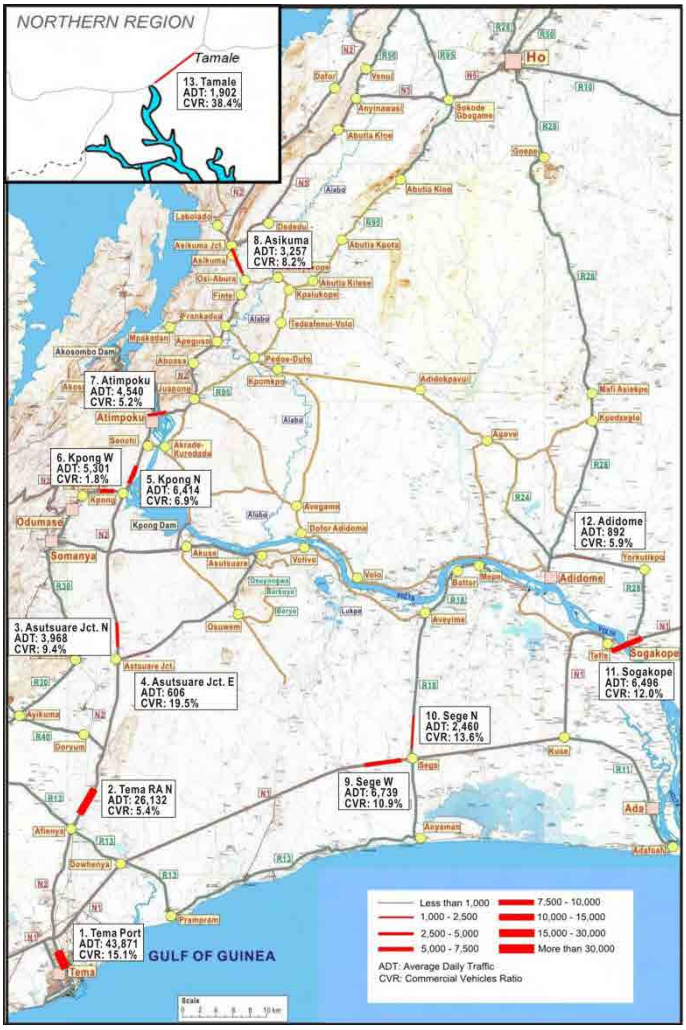
a) Contents of Traffic Surveys

- The number of locations for the Manual Classified Counts (MCC) Survey was 13 in total, consisting of 12 locations in the Study Area in the Greater Accra, Eastern and Volta Regions and 1 location on the Central Corridor close to Tamale in the Northern Region.
- For the Roadside Origin and Destination (O/D) interview Survey, drivers passing through the survey stations were interviewed in order to obtain data regarding traffic tendency. The number of locations for the O/D Survey was 10 in total, consisting of 9 locations in the Study Area and 1 location close to Tamale. The O/D Survey stations coincided with some of the MCC Survey locations. Questions asked during the interview included: 1) vehicle type, 2) origin/destination of trip, 3) purpose of the trip, 4) travel time from origin to destination, 5) category of commodity, and 6) route.
- The Study Area and the other areas in Ghana and neighbouring countries were divided into 44 zones considering the purpose of the Study, which was to forecast future traffic demand on the new Eastern Corridor from Asutsuare Jct. to Asikuma Jct., and the existing Asutsuare – Aveyime road.

b) Results of Traffic Surveys

The results of the MCC for sectional traffic volume were converted to average daily traffic (ADT) using the factors derived from the biographical survey and analysis based on tollbooth traffic data and reports. The results are shown in Figure-12.

After checking and correcting the data obtained from the O/D survey, they were input and the O/D matrix was created to represent the origin and destination of respective trips. In order to grasp the trip behaviour in terms of ADT, the matrixes were expanded utilising the ADT computed at each survey station. Finally, the O/D matrixes by location were compiled into one matrix. In accordance with the combined matrix, trip generation-attraction was calculated by zone as shown in Table-3. In addition, the desired line diagrams were prepared to understand traffic conditions visually as shown in Figure-13.



Source: Study Team

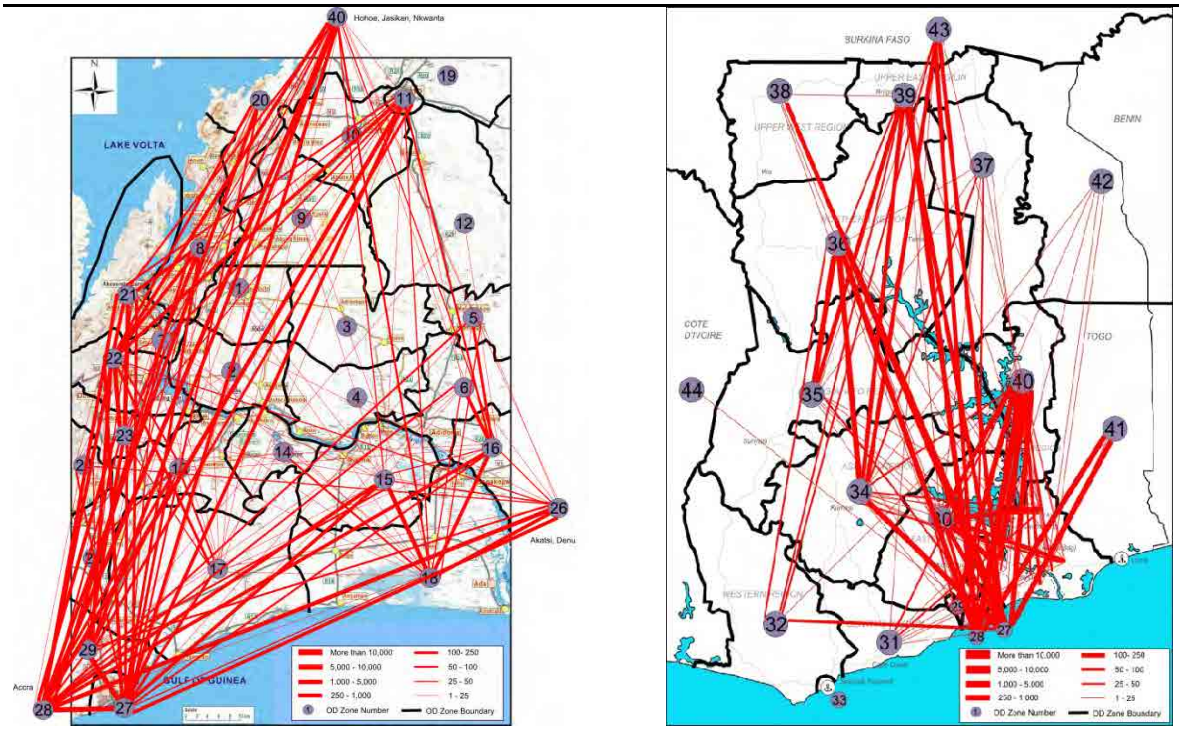
Figure-12 Summary of ADT at the Survey Locations

Table-3 Estimated Major Trip Generation–Attraction

Zone Number	Zone Description	Trip Generation- Attraction (Vehicle/day)
27	Tema Port Area	17,379
28	Accra Centre	17,262
29	Western Greater Accra without 27 and 28	8,292
22	Kpong, connecting with N2 and N3	6,082
26	Akatsi, Eastern part of Volta Region	4,500
40	Northern part of Volta Region	3,554
23	Somanya, N2 between Asutsuare and Kpong	3,551
11	Ho Centre	3,411
18	Sege, Kase, Ada	2,568
21	Akosombo	2,559
15	Aveyime, Battor, Mepe	2,337
8	Juapong, Frankadua, Asikuma	2,026
16	Sogakope	1,785
43	Burkina Faso, Mali, Niger	1,532
34	Ashanti Region, Kumasi	1,248
30	Eastern Region without Study Area	1,217
36	Western side of Northern Region, Tamale	1,562

Note: Trip generation-attraction in zones outside of the Study Area does not indicate the whole traffic because of the survey locations

Source: Study Team



Source: JICA Study Team

Figure-13 Desired Line Diagram of Present Traffic

c) Present Characteristics of Traffic and Logistics

1) Traffic Characteristics

- The main trip generation- attraction areas are Zones 27 and 28, which represent Tema Port and Accra respectively.
- Ho (Zone 11) is also a major trip generation-attraction zone especially from/to Tema Port, Accra and Kpong.
- The area to the north of the Volta River such as Zones 1, 2, 3 and 4 does not generate and attract so much trips.
- Similar to the traffic characteristics in the Study Area, the main trip generation-attraction areas are Tema Port and Accra, with estimated ADT of 17,000 respectively, excluding internal trips.
- The trip generation-attraction volume in Zone 43, which includes Burkina Faso, Mali and Niger, was estimated at ADT of 570, with 70% of vehicles travelling from/to Tema Port and Accra in the Study.
- Of the 1,500 traffics from/to Tamale, 600 were travelling from/to Accra and Tema Port.

2) Logistics Characteristics

Apart from the O/D matrixes used for forecasting future traffic demand, an O/D matrix only for freight vehicles was created in order to grasp the logistics characteristics in and outside the Study Area. Freight vehicles are defined as “Heavy truck”, “Trailers” and “Others” in the Study.

Trip generation-attraction of freight traffic by zone is shown in Table-4.

Table-4 Estimated Major Trip Generation-Attraction of Freight Traffic

Zone Number	Zone Description	Trip Generation-Attraction Traffic (ADT)
27	Tema Port Area	3,045
28	Accra Centre	1,952
34	Ashanti Region, Kumasi	702
39	Upper East Region	647
36	Western side of Northern Region, Tamale	625
43	Burkina Faso, Mali, Niger	453
41	Togo South, Lome Port	335
26	Akatsi, Eastern part of Volta Region	305
15	Aveyime, Battor, Mepe	277

Note: Trip generation-attraction at stations outside the Study Area do not indicate the whole traffic because of the survey locations.
Source: Study Team

Key features of the present logistics characteristics are as follows:

- The main trip generation-attraction zones of freight traffic are Tema Port and Accra, the same as the traffic conditions for all vehicles.
- The proportion of cross-border freight vehicles is higher. Especially, freight traffic from/to landlocked countries such as Zone 43 was estimated at 1,415 vehicles per day.
- Of 232 vehicles from/to Tamale, 138 were from/to Accra and Tema Port.
- Freight traffic from/to Aveyime, Battor and Mepe such as Zone 15 mainly flows south or southwest such as Tema, Accra and Sege-Ada area.
- Most of the freight traffic from/to the northern part of the Volta Region consists of traffic from/to Tema Port and Accra.

(2) Future Traffic Demand Forecast

a) Methodology and Results of Future Traffic Demand Forecast

The methodology for traffic demand forecast is based on the most standard method called the “Four Steps Methodology”, but without the modal split.

1) Step 0: Analysis of the Present Traffic

The present traffic conditions are analysed based on the results of the MCC and the roadside OD surveys. This analysis is indispensable for forecasting demand.

2) Step 1-1: Trip Production

In the Trip Production step, the integrated traffic demand of all vehicle types is estimated. This forecasted number is used to control the total traffic volume estimated in the next step. The forecast is based on socio-economic conditions such as the population and GDP.

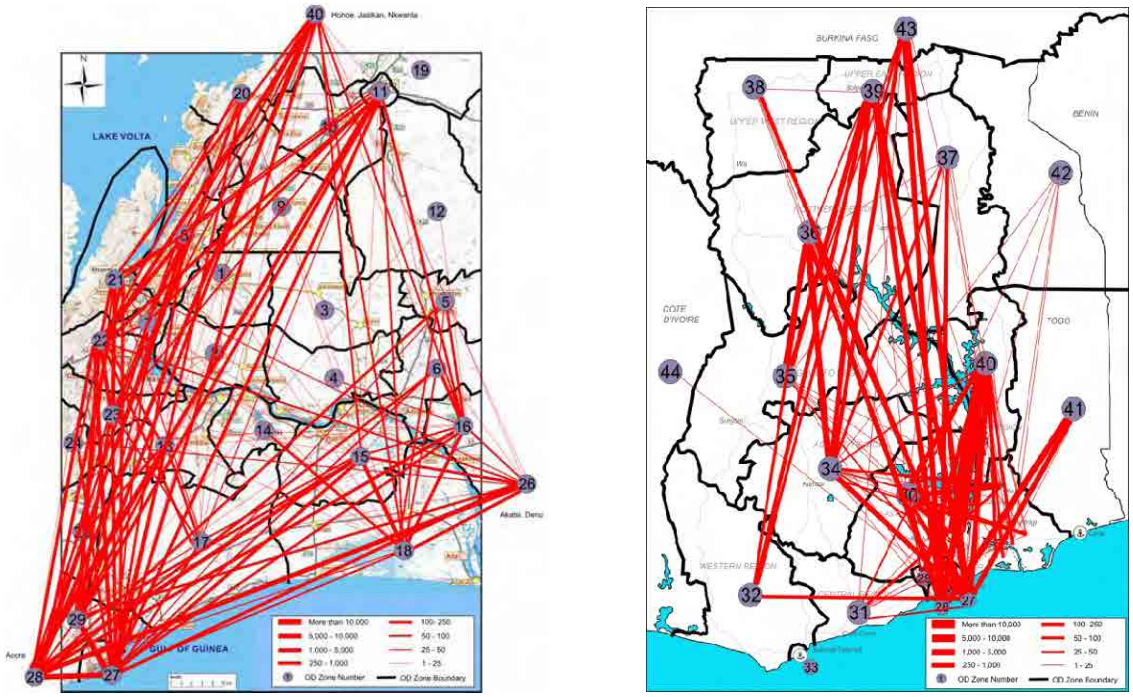
3) Step 1-2: Trip Generation and Attraction

The generated/attracted traffic demand by zone is forecasted based on the model built using a regression analysis of the present traffic volume and the socio economic indicators. As the cumulative number of trip generation and attraction is not consistent with the produced demand, it is subsequently adjusted according to the estimates of trip production calculated in Step 1-1.

4) Step 2: Trip Distribution

Based on the present distributed traffic volume (Present O/D matrix) in 2012 derived from field

traffic surveys and the projected growth factor of the generated and attracted traffic demand, the prospective distributed traffic demands are forecasted separately for passenger-carrying vehicles and freight vehicles through the iterative method called “Fratar Method” or “Present Pattern Method”. The desired line diagrams for the future traffic demand in the target year of 2036 are shown in Figure-14.



Source: Study Team

Figure-14 Desired Line Diagram of Future Traffic (2036)

5) Step 3: Route Assignment

This step allocates trips between an origin and destination by vehicle type (Future O/D Matrix) to a route using a road network model.

Road network models are individually generated for ‘with-the-project’ and ‘without- the-project’. The ongoing and planned road development projects are also considered in the road network models.

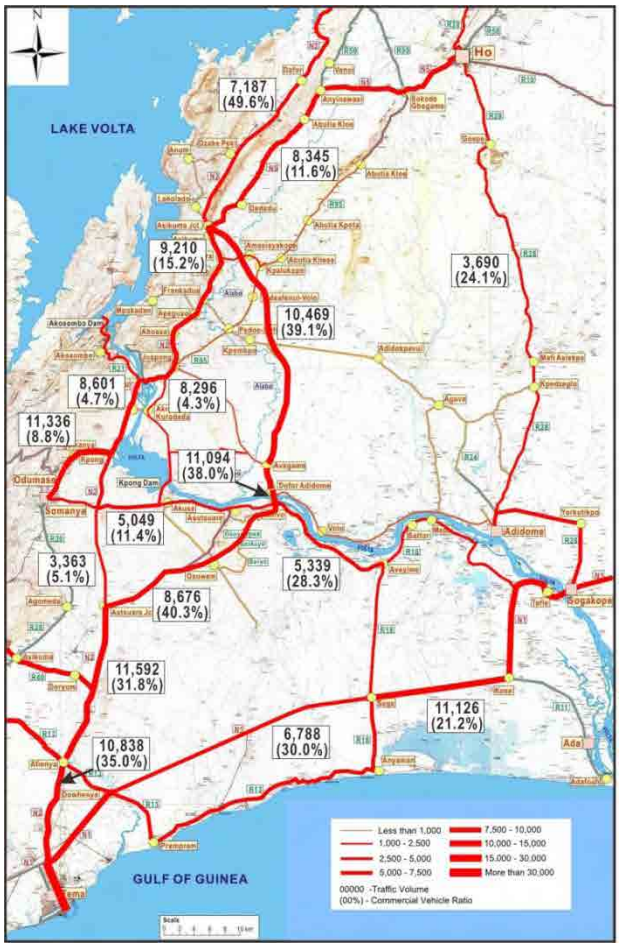
Route assignment by vehicle type was conducted using the distributed traffic demand (Future O/D matrix) and the road network model. The “Divisional Distribution Method”, which is the most common method of route assignment, is used in order for each bunching to select the optimal route. The result of the route assignment in 2036 is shown in Figure-15.

b) Future Traffic Characteristics

1) Diversion of Traffic

- Since the distance from Tema Port to the landlocked countries and Tamale via the Eastern Corridor is shorter than that through the Central Corridor, freight traffic would divert to the Eastern Corridor if road condition of the Eastern Corridor, including Asutsuare Jct. to Asikuma Jct., is improved.

- In the study, most of freight vehicles between Tema Port/Accra and landlocked countries/Tamale are diverted from the Central Corridor to the new Eastern Corridor.
- The construction of the planned new N2 will ease traffic congestion on the existing N2 around Kpong and Atimpoku by diverting passenger-carrying vehicles to the new N2. In the Study, the ratio of passenger-carrying vehicles between the existing N2 and the new N2 is approximately 1:1 based on the results of traffic demand forecasts for 2036.



Source: Study Team

Figure-15 Result of the Route Assignment in 2036

5. Results of Natural Condition Survey and Hydrological Analyses

(1) Results of Natural Condition Surveys

- The Study Team conducted profile and cross-section survey along the proposed road alignment between Asutsuare Jct. and Asikuma Jct., and Asutsuare and Aveyime, as well as land survey of some areas in order to identify detailed topographical conditions.
- The Study Team conducted a bathymetric survey at four locations over the Volta River As a result of the bathymetric survey, the river bed at each alternative bridge location were identified to be about 6.0 m to 7.0 m.
- The Study Team conducted boring works at 10 locations. The results of boring works indicated that competent rock would likely be encountered around 6 m and 20 m from the water level and surface on both banks of the Volta River, respectively.

(2) Results of Hydrological Analyses of the Volta River and the Alabo River

a) Volta River

The discharge of the Volta River in the Study Area is subject to the restriction of the Kpong Hydroelectric Dam located upstream of the Study Area as follows:

- Discharge under normal conditions: 1,500 m^3/s
- Discharge at the time of flooding: 3,000 m^3/s

The current velocity at normal condition is calculated by the Manning formula using the river cross-sections, which are drawn based on the results of the bathymetric survey and topographical

survey. The current velocity of surface water is estimated to be 1.1 to 1.4 times of the average current velocity. In this case, the current velocity at the alternative bridge location B-2, which is estimated as the fastest value (0.60 m/sec) will become 0.66 to 0.84 m/sec.

The high water level is estimated based on the abnormal river flow at the time of flood (Q=3,000m^3/s) and the flow area of the alternative bridge location B-2, where the river cross-section is smallest among three alternative bridge locations. Based on the relation between the water level and the flow area, the elevation of the high water level (+12.74), which is 3.5 m above the water level in the normal condition observed by the bathymetric survey (+9.24) can handle the water flow during a flood (Q = 3,000 m^3/s). The bridge height is considered as 7 m from the water level in the normal condition, to maintain consistency with the existing Lower Volta Bridge.

b) Alabo River

The proposed site of the bridge to cross the Alabo River is just to the east of Amasiayakope township: there is also a bridge (M-11) across the same Alabo River on the feeder road between Osi-Abra and Kpalukope, which was constructed in 2003 under the by Japanese Grant Aid programme. Since the proposed bridge site is only 300–400 m away from this M-11 bridge and the topography around the two bridge sites is the same, the Study Team assumed that the hydrological condition of the two bridge sites are also the same.

- Catchment area: 678 km^2
- Water discharge volume: 230.0 m^3/sec (50-years return period)
- Planned river width: 45.0 m
- High water level: 58.9 m (EL)

(3) Salinity Measurement

There is a possibility of backflow of seawater reaching the proposed bridge locations because the inclination of the river bed of the Volta River is very gentle at 1/30,000 and the height of the river bed is 5 m below sea level. Thus, the Study Team conducted salinity measurements in order to collect basic data for planning of the new bridge over the Volta River. Salinity was 0.0% around the alternative bridge locations (B-3), meaning that salt water does not reach these locations.

6. Selection of Desirable Route for the Feasibility Study

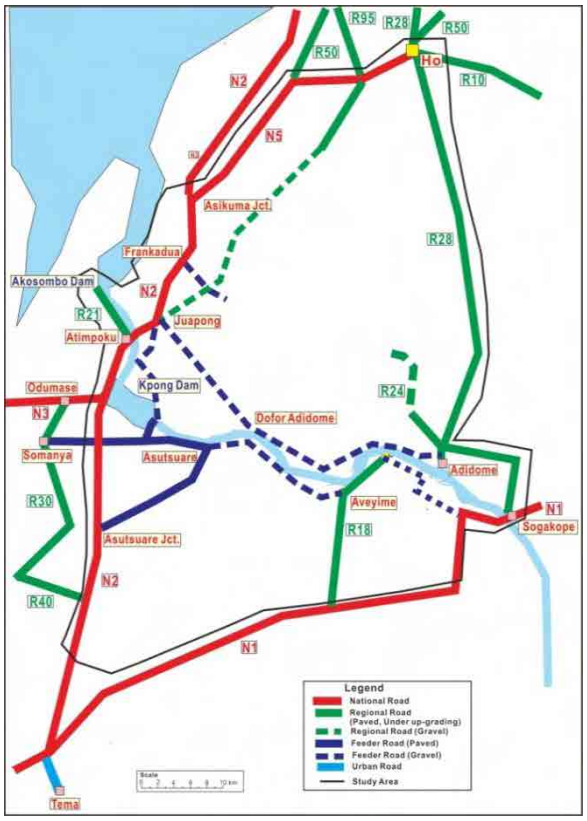
(1) Strategies for Development of the Road Network in the Study Area

a) Future Road Network Configuration in the Study Area

Figure-16 illustrates the present road hierarchy in the Study Area. Considering the functional hierarchy of the road network and regional development trend, the north-south axis and the east-axis on both the left and right sides of the Volta River are weak. In order to accelerate the regional development, particularly agricultural development, the Study Team proposes the future road network configuration in the Study Area as shown in Figure-17.

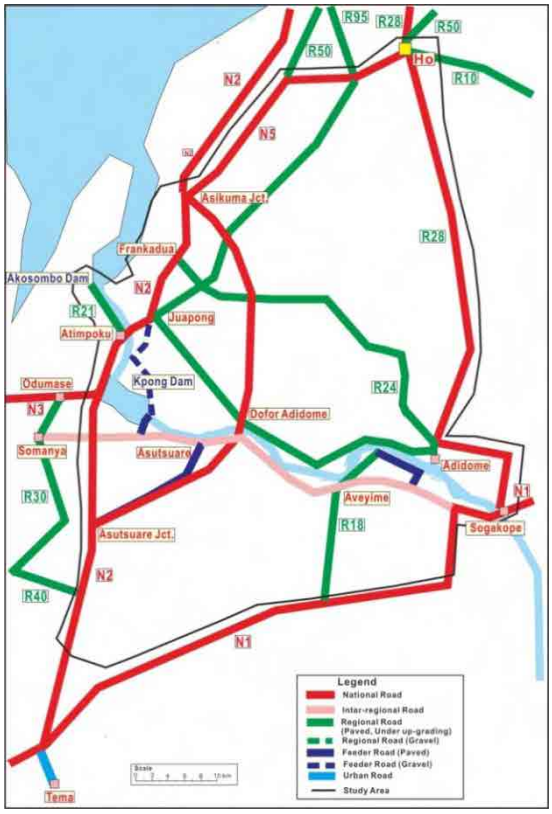
Under this proposed road network configuration, the new proposed route between Asutsuare Jct. and Asikuma Jct. will be classified as a national trunk road with a function as an international corridor between Tema Port and the border with Burkina Faso, while the road section between Asutsuare and

Aveyime will be a part of the inter-regional road connecting N2 and N1 via the southern green-belt area of Ghana, where major rice production is expected.



Source: Study Team

Figure-16 Present Road Hierarchy in the Study Area

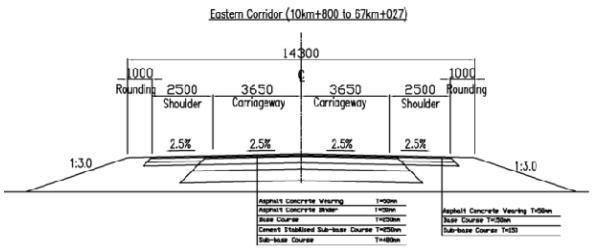


Source: Study Team

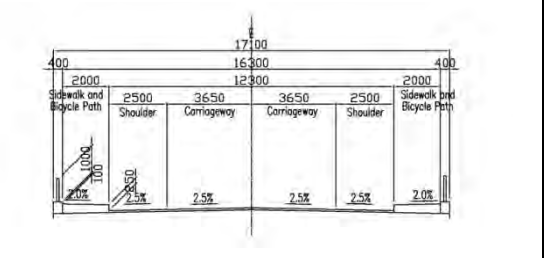
Figure-17 Proposed Road Network Configuration in the Study Area

b) Design Standards Applied for the Study Roads and Bridges

- The design speed of 100 km/h and 80 km/h is proposed for the new road sections between Asutsuare Jct. and Asikuma Jct., and Asutsure and Aveyime, respectively, because the entire proposed route lies on flat terrain.
- In order to accommodate international logistics freight vehicles, mainly large trailers, to secure traffic safety, and to harmonise with the natural and topographical conditions, the radius of curves is designed to be gentle. It is desirable to use a radius of more than 2,000 m or at least 1,400 m corresponding to two or three times the minimum design standard.
- The Study Team proposed several alternative cross sections at the working group meeting with GHA officials, and both sides agreed to adopt the cross sections. Figures-18 and 19 show typical cross-section for new road between Asutsuare Jct. and Asikuma Jct., and Asutsuare – Aveyime road, respectively. In a case of bridge, 2.50 m shoulder is proposed to cope with any unexpected situation, such as an accident, on a long bridge.
- 90 m ROW is applied for the new road section between Astsuare Jct. and Asikuma Jct. on the Eastern Corridor, while 60 m ROW is applied for the Asutsuare – Aveyime road.



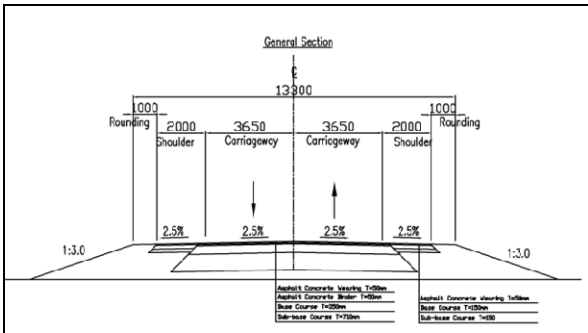
Typical Cross- section of Ordinary Section



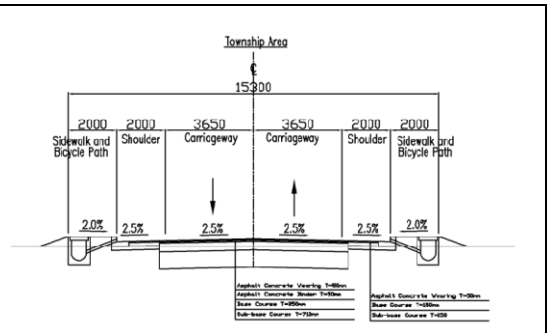
Typical Cross-Section of Bridge

Source: Study Team

Figure-18 Typical Cross Section of New Road between Asutsuare Jct. and Asikuma Jct.



Typical Cross- section of Ordinary Section



Typical Cross- section In Township Area

Source: Study Team

Figure-19 Typical Cross Section of Asutsuare – Aveyime Road

(2) Road Alignment Study

a) Road Alignment Study between Asutsuare Jct. and the Volta River

The Study Team prepared five possible alternative routes between Asutsuare Jct. and the Volta River, in the southern part of the Study Area (S-1, S-2, S-3, S-4 and S-5), which was presented at the First Working Group Meeting (WGM) held on 18th April, 2012 for the first screening of alternative routes. Based on the results of discussions in the WGM, alternative road alignments S-1, S-2, S-3 and S-4 were selected for the further study. Alternative road alignment S-5 was not selected because it could encroach on the area where Golden Exotic Ltd. plans to expand its banana estate.

b) Study of Alternative Bridge Location over the Volta River

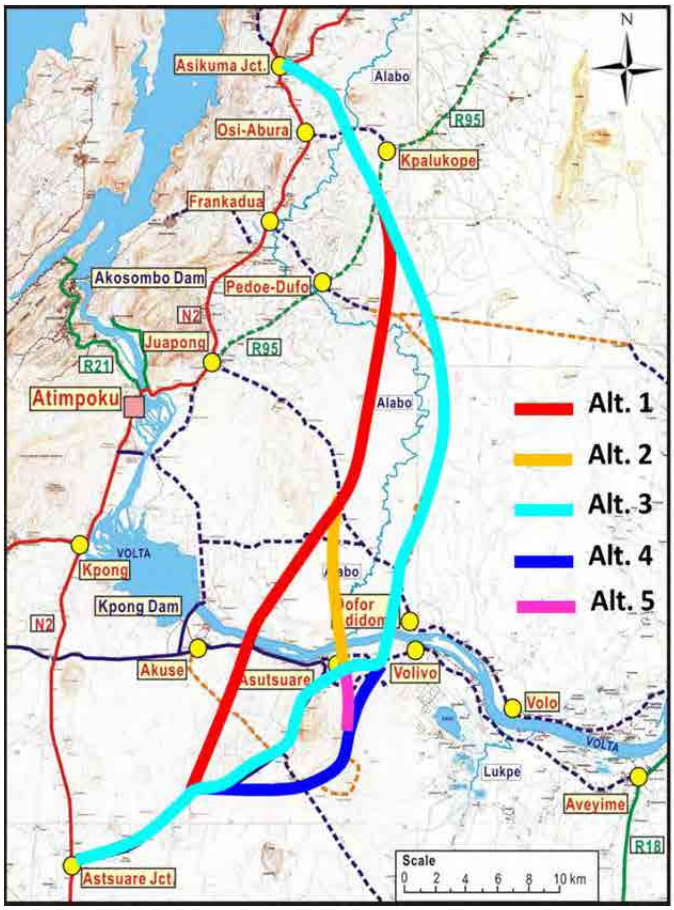
The Study Team considered four possible locations of a bridge over the Volta River between Akuse and Volivo (B-1, B-2, B-3 and B-4). Then, the Study Team presented the possible bridge location at the First Working Group Meeting for the first screening of locations.

Based on the results of discussions in the WGM, locations B-1, B-2 and B-3 were selected for further study, while B-4 was not selected because alternative road alignment S-5, which connects to B-4, was dropped.

c) Road Alignment Study between the Volta River and Asikuma Jct.

- The Study Team prepared three possible alternative routes between the Volta River and Asikuma Jct. on the National Road N2, in the northern part of the Study Area (N-1,N-2, and N-3), and presented them in the First Working Group Meeting for the first screening of alternative routes.

- Since both Alt. N-1 and N-2 will require upgrading of the existing N2, which passes through several townships, every participant of the WGM agreed to screen out Alt.N-1 and N-2. In addition, the GHA requested the Study Team to consider a fly over at Asikuma Jct. if future traffic demand will exceed the capacity of the at-grade intersection. The result of traffic analysis of the Asikuma Jct. indicates that at-grade intersection with signalized control is sufficient for the traffic demand up-to 2030.
- Based on the results of discussions in the WGM, an alternative road alignment N-3 was selected for further study.



Source: Study Team

Figure-20 Alternative Route Alignments between Asutsuare Jct. and Asikuma Jct.

(3) Further Studies for Selected Alternatives

a) Alternative Route Alignments

The Study Team conducted the detailed site investigations for the alternative alignments S-1, S-2, S-3 and S-4 in the south and N-1 in the north after the WGM. As a result, the Study Team identified an additional alternative alignment. Therefore, there are five alternative routes for further study: Alt. 1, Alt. 2, Alt. 4 and Alt. 5, as shown in Figure-20.

b) Bridge and Drainage Structure Study

Construction of a bridge is proposed for a location where the alternative routes cross the following rivers. While the Study Team proposes that drainage structures over small streams (less than 30 m of width) and an irrigation canal are planned to be concrete culverts (either box culver or pipe culvert).

- Alt. 1: Lomen River (100 m), Gblo River (30 m), Alabo River (55 m)
- Alt. 2: Lomen River (50 m), Alabo River (55 m)
- Alt. 3: Lomen River (50 m)
- Alt. 5: Alabo River (55 m)
- Common section in the north: Alabo River (50m)

A continuous T-girder bridge is selected for the following reasons:

- Continuous structures, which are more resistant to earthquakes, are mainly compared.
- Concrete bridges are less-maintenance and economical.
- These types of bridges are commonly used in Ghana.

- As PC continuous composite girder bridge is unfavourable in terms of ease of construction and quality control compared with a PC continuous T-girder bridge, and offers no advantage.

(4) Preliminary Study of Bridge across the Volta River

The Study Team conducted detailed site surveys for the selected alternative bridge locations B-1, B-2 and B-3, mainly considering topography and river condition.

- Bridge length at B-1 for Alt. 1: 620 m
- Bridge length at B-2 for Alt. 2 and Alt. 5: 530 m
- Bridge length at B-3 for Alt. 3 and Alt. 4: 580 m

The bathymetric survey and geotechnical investigation revealed the following natural conditions at the proposed locations of alternative bridge sites.

- The Volta River, with a maximum riverbed depth of 6–8 m.
- The Volta River has a uniform current which is controlled by the Kpong Dam and the velocity is approximately 0.6 m/s.
- The river water is not saline.
- The support layer is very near to the river bed, with a minimum depth of 3–6 m from the river bed.
- The support layer is a very hard rock layer with an N-value of more than 300.

The bridge site is located near an active fault which experienced a big earthquakes in 1862 and 1939, and the Study Team expects an earthquake to occur at the active fault. The expected magnitude of that earthquake is considered to be 6.5, the same as the earthquake in 1862. The epicentre distance is expected to be 10 km in the worst situation.

The Study Team has carried out the first step comparison of alternative superstructure types (seven alternatives steel bridges and six alternative PC bridges), and the following three alternative superstructure types were selected

- Alternative 1: Steel-3 – Continuous cable-stayed bridge (Span: 117.5 + 265.0 + 117.5)
- Alternative 2: PC-2 – Continuous box girder bridge (Span: 70 + 3@120 + 70)
- Alternative 3: PC-3 – Continuous extradosed bridge (Span: 95 + 2@155 + 95)

The economical reverse T-style abutment was selected in the first-step comparison, and the height of abutment was determined as 12 m, which is the marginal height of a reverse T-shape abutment, in order to reduce the bridge length. The economical direct foundation was selected for the foundation type, as a sandy gravel layer with an N-value of more than 50 exists at the bottom of the planned footings.

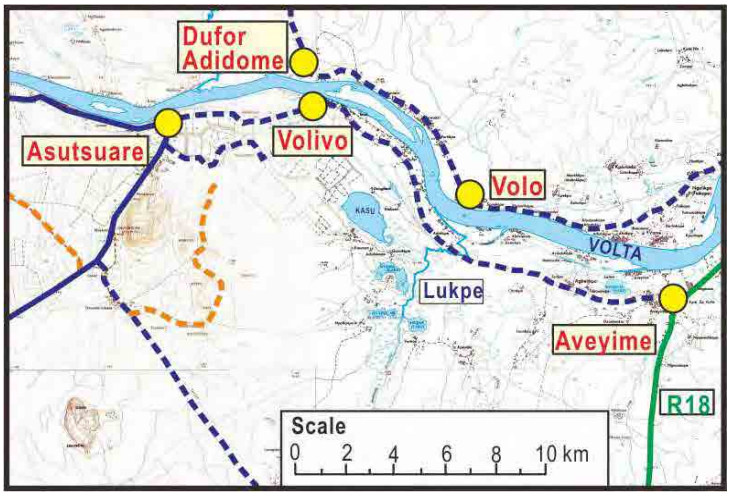
The column type elliptical pier was selected as the pier type, in order to minimise the obstruction of river flow, as most of the piers will be constructed in the river. The economical direct foundation was adopted for the foundation, because a hard rock layer was found at a shallow level.

(5) Road Alignment Study between Asutsuare and Aveyime

According to the GHA, the category of feeder road section between Asutsuare and Aveyime will be changed in part to an inter-regional road connecting Somanya and N1 via Akuse, Asutuare, and

Aveyime after the improvement is completed.

Since the classification of this road will become an inter-regional road, the Study Team proposes that the horizontal alignment of this road section should basically follow the existing road alignment, except at sections on the east of Asutsuare township, where the existing road crosses two irrigation canals: in Volivo township, where the present alignment will not satisfy the minimum curve radius: and in Aveyime township, where some houses are encroaching on the road and there is a T-shape intersection adjacent to the Aveyime roundabout.



Source: Study Team

Figure-21 Location of Asutsuare and Aveyime Road

The preliminary design of this road section will be carried out in the next stage of the Study, when topographical maps will be created based on topographical surveys.

(6) Rough Cost Estimation

a) Road Construction Cost

- Comparing the prices of N2 Lot2 and prices of A/C paved road, the construction price is between US$0.76 million and US$1.80 million/km (2012 price). The project site is easily accessible from Accra and Tema Port, and there are some quarry sites nearby. Thus, the construction unit price is estimated to be US$1.4 million/km considering lower haulage and availability of cheaper aggregates.
- The unit price for reconstruction of ordinary road section is estimated to be US$570,000/km (GHA's unit price 2012). There is a possibility to raise unit price in case of relatively larger scale works than the above mentioned reconstruction of ordinary road sections, referring to unit price of the Kumasi and Techiman road project.
- Cost for replacement of black cotton soil is estimated to be US$ 17/m^3.

b) Bridge Construction Cost

The unit price for general bridge works is estimated at US$ 4,000/m^2 by the following reasons:

- This project site is not far from Accra and Tema Port, and thus the haulage is assumed to be lower than the average.
- Most of unit price for bridge works is constituted to imported material or imported equipment. Thus, unit price for bridge works is not sensitive to inflation.
- SMTDP estimation and 4 Bridges package may include other costs.

The unit price for the bridge over the Volta River is estimated at US$ 7,000/m^2 for the following reasons.

- Unit price for the bridge over the Volta River is estimated with reference to the Abay Bridge in Ethiopia, which is one of long span bridges constructed in Africa by Japanese Grant Aid Programme.
- Unit price of Abay Bridge works is not affected by inflation, because the bridge was constructed by Japanese Grant Aid and most of bridge materials and equipment were imported.

c) Rough Cost Estimation of Each Alternative

The estimation for each alternative is calculated based on unit prices described above.

(7) Process of Selecting the Desirable Route

After the first screening of alternative route alignments for a part of the Eastern Corridor between Asutsuare Jct. and Asikuma Jct., the Study Team carried out the preliminary studies, including a detailed site investigation, data collection related to regional development, and a baseline survey for environmental and social considerations.

(8) Evaluation Criteria

a) Environmental and Social Considerations

The Study Team carried out a baseline survey of environmental and social considerations, and evaluated each alternative route.

- Alternatives were evaluated based on the environmental impact of the following parameters: physical environments, land and land use, impacts of natural resources on people, traffic conditions and infrastructure, as well as negative and positive impacts on society.
- The Study Team then evaluated weather each alternative is 'recommended' in terms of environmental and social considerations.

b) Impact on Regional Development

Impacts on regional development are considered to be as follows:

- Impact on Agricultural Land
- Impact on Agricultural Development Scheme
  As the proposed alignment of Alt. 2 and 5 pass through the centre of development scheme by an Israeli company, the road would disturb the scheme
- Development of Arable Land
  The area on the eastern side of the Alabo River (about 15,000 ha) has not been developed, mainly due to lack of access roads to this arable land. The construction of a new road through this area would contribute to development of this arable land.

c) Engineering Aspects

The following engineering aspects were considered in the evaluation:

- Realignment of Existing Road
- Watercourses
- Minimum Radius and Maximum Longitudinal Gradient

d) Economical Aspects

- Initial Investment Cost

- Black Cotton Soil
- Number of Bridges

e) Other Aspects

- Transport Redundancy
- Passing through or by Communities

(9) Evaluation of Alternative Routes

a) Evaluation of Alternative Routes between Asutsuare Jct. and Asikuma Jct.

- Regarding environmental and social considerations, Alt.1, Alt.4 and Alt.5 are recommended, while Alt.2 and Alt.3 are not recommended, because these two alternative routes are planned to pass the community in Asutsuare township and their negative impacts for the social lives in Asutsuare are judged as higher than other alternative routes. As a result, Alt. 2 and Alt. 3 are dropped for the further evaluation
- From the impacts on regional development point of view, Alt. 4 shows the highest score. In a case of Alt.5, the route alignment is directly going through the centre of agricultural development carried out by an Israeli company. This company is not happy that the proposed route would pass through their premises. Also, this route will generate internal traffic within cultivation land crossing the proposed road and this situation should be avoided. As a result, the Study Team dropped Alt. 5 from the further comparison.
- For the comparison between Alt. 1 and Alt. 4, even though scores of both alternatives are not much different and length of road is shorter for Alt. 1, there are two critical conditions in a case of Alt. 1, that are 'realignment of existing road' and "affected watercourses'. Thus, the Study Team dropped Alt. 1 from candidate routes alignment for the F/S.
- In order to reduce the area of paddy fields in the southern part of the Volta River affected by Alt. 4 (from 22 ha to 6 ha) as well as to improve the horizontal alignment with a continuous curve of 1,800–2,000 m radius, the Study Team will further examine the alignment of Alt. 4.

b) Improvement of Road Section between Asutsuare and Aveyime

The negative impact of improving the road section between Asutsuare and Aveyime is the necessity of resettling a few houses and temporary shops in Volivo and Aveyime townships. On the other hand, the positive impact for society is improved access for people, goods and social services.

(10) Results of Evaluation and Proposed Alternative for the F/S

a) Road Section between Asutsuare Jct. and Asikuma Jct.

The first Workshop was held on 18th May 2012, to discuss the priorities of alternative routes for selecting the highest priority route for carrying out the F/S in the second stage of the Study. However, the workshop was unable to select a particular alternative for the F/S.

Since a particular alternative for the F/S could not be selected in the First Workshop, the Study Team and the GHA held further discussions, and the GHA finally agreed to select Alt. 4 for the F/S in the meeting held on 1st June, 2012.

b) Road Section between Asutsuare and Aveyime

Based on the discussion, the GHA agreed with the idea of the Study Team to mainly follow the present alignment for the improved road section between Asutsuare and Aveyime, but a typical cross section with the inter-regional road should be adopted even in townships.

7. Preliminary Design for Construction of Road between Asutsuare Jct. and Asikuma Jct.

(1) Justification for Construction of Road between Asutsuare Jct. and Asikuma Jct.

With four positive impacts: 1) to avoid crossing the existing Adomi Bridge, 2) to avoid passing through congested township on the existing N2, 3) to attract more investment for agricultural development, and 4) able to accommodate international freight traffic, the Study Team considered that carrying out the F/S for the construction of new road between Asutsuare Jct. and Asikuma Jct., including new bridge across the Volta River, is justified.

(2) Preliminary Design of Road

a) Horizontal and Vertical Alignment

- The design speed for the proposed Eastern Corridor is 100 km/h.
- There are several crossing rivers, watercourses and canals to be considered for the preliminary design of the road section between Asutsuare Jct. and Asikuma Jct.
- Facilities over the two main rivers, the Volta River and the Alabo River, are needed to construct bridges, and facilities over the canal to banana estates (No. 23 km+265) and the APGIP main canal (No. 23 km+305) are needed to construct a bridge of 51.7 m in length.
- The Study Team compared the original alignment, for which a desirable route was selected by the first Workshop, and an alternative alignment in order to reduce the impact on the paddy fields of the KIP in the southern part of the Volta River. The alternative alignment is advantageous in terms of construction cost and traffic safety for agricultural traffic in the KIP.

b) Pavement Design

As it has become common practice to use the cement stabilized gravel sub-base course for the trunk road improvement works by the GHA and the GHA requested the Study Team to adopt this concept for the pavement design for the new road construction between Asutsuare Jct. and Asikuma Jct. Thus, the Study Team consider to adopt this concept for the pavement design. Recommended pavement thicknesses of Segments 1 to 3 for the economic reason as well as greater durability against the weather thanks to its higher impermeability and strength of sub-base course. are shown in Table-5.

c) Road Drainage

The catchment area is obtained from 1/50,000 scale topographic maps, and the frequency of occurrence for road culverts crossing the proposed road between Asutsuare Jct. and Asikuma Jct. such as watercourses, branches of the Romen River and branches of the Alabo River is determined as 10 years based on the Ghana Road Design Guide. Then, the inner sizes of planned facilities such as road culverts are determined for each planned culvert.

Table-5 Recommended Pavement Composition

Pavement	Segment 1* Asutsuare Jct. – 10 km+800	Segment 2 10 km+800 – Volivo	Segment 3 Dufor Adidome – Asikuma Jct.
Asphalt Concrete Wearing	5 cm	5 cm	5 cm
Asphalt Concrete Binder	5 cm	5 cm	5 cm
Base Course	25 cm	20 cm	20 cm
Cement Stabilised Sub-base Course	25 cm	24 cm	24cm
Sub-base Course	48 cm	-	-
SN	8.14 > 8.12…OK	5.29 > 5.21…OK	5.29 > 5.23…OK
Cost	US$ 64.07 /m^2	US$ 57.29 /m^2	US$ 57.29 /m^2

Note: Pavement composition was calculated based on the results of the resilient module test, due to the existing road section.
Source: Study Team

d) Intersection Design

There are three intersections where two or more trunk roads join or cross to be considered in the Study Area as a result of newly constructing the road between Asutsuare Jct. and Asikuma Jct. Based on the analysis of the future traffic volume at each intersection and a strong request from the GHA, the Study Team recommends roundabouts for all three intersections.

e) Traffic Safety and Management

- Guardrails are required where there is a high embankment of more than 3 m and at other necessary sections. Guardrails are located at outside shoulders of 2.5 m.
- Appropriate pavement markings are provided to control traffic movement, and to warn and guide motorists and pedestrians. Danger warning signs, regulatory signs and information signs are placed in appropriate locations.
- In large settlements where pedestrians cross the road, apart from the mandatory speed limit sign of 50 km/h, grade separations by footbridges for pedestrian crossings are recommended in order to minimise frequency and severity of accidents in settlements based on the strong request by the GHA.
- Bus bays are provided along the proposed road where necessary.
- The GHA has a plan to collect toll from vehicles crossing the new bridge across the Volta River. Hence, it is proposed to place a toll plaza near the Volta River Bridge for collecting the toll from vehicles crossing the river.

f) Rest Stop

- The Linda Dor rest stop currently in use on the Central Corridor is an appropriate model for the proposed rest stop on the Eastern Corridor.
- The proposed location of the rest stop is as close to the new Volta Bridge as possible.

(3) Preliminary Design of Bridge

a) Preliminary Design of Bridge across the Volta River

- Based on the three alternative superstructure types selected by the first-step comparison, the Study Team carried out the second-step comparison to select the most suitable superstructure type in consideration of the design conditions. As a result, Proposal 1: Continuous cable-stayed bridge was selected.

- The reverse T-style abutment was selected, since the height of abutments will become about 8 m. The piling foundation was selected at this stage, instead of the direct foundation, in order to secure the safety of abutments, in case scouring occurs on the natural embankment in front of the abutments.
- The column type elliptical pier was selected as the pier type, in order to minimize the obstruction of river flow. The economical direct foundation was also adopted for the foundation, because a hard rock layer was found at a shallow level. Proposal 2: single steel pipe sheet pile cofferdam method was selected for the cofferdam method for constructing the piers.

b) Preliminary Design of Bridge across the Planned APGIP Main Canal

- The bridge length was determined as 50 m = 2@25 m, in consideration of the location of the existing and planned canals.
- The reverse T-style abutment was selected, since the height of the abutment will be 10 m. The economical direct foundation was selected for the foundation type, as a rock layer with an N-Value of more than exists at the bottom of planned footings.
- The column type elliptical pier was selected as the pier type, in order to minimize obstruction of river flow, as the piers will be constructed in the river. The economical direct foundation was adopted for the foundation, because a hard rock layer was found at a very shallow level.

b) Preliminary Design of Bridge across the Alabo River

- The bridge length was determined as 50 m = 2@25 m, in consideration of the location of the existing and planned canals.
- The reverse T-style abutment was selected, since the height of the abutments will be 8 m. The economical direct foundation was selected for the foundation type, as a rock layer with an N-value of more than 30 exists at the bottom of the planned footings.
- The column type wall pier was selected as the pier type, because this type was more economical and easier to construct than other type. The economical direct foundation was adopted for the foundation, because a hard rock layer was found at a very shallow level.

(4) Implementation Programme for Construction of Road between Asutsuare Jct. and Asikuma Jct.

a) Construction Method

- Implementation of major works such as earth works and pavement works should be considered to avoid rainy season. Regarding bridge construction other than the bridge over the Volta River, it should avoid to construct substructures and abutments during rainy season where the water level rises.
- It is recommended to use hot weather concrete in aspects of quality management of concrete works.
- It is required to secure proper traffic during under construction by providing detours
- Relocation and removal of the existing electric poles and lines are needed if electric poles are within the road width. The Study Team confirmed that height from ground to the lowest level of

line is approximately 10 m as well as there is not any vertical steel towers within both sides of 100 m form the proposed centre line.

b) Material and Equipment Procurement

- Since quarry sites for procurement of aggregate are dotted around the project site, aggregate could be available relatively easily. However, it should be examined procurement in detailed at the construction stage considering stable supply qualitatively and quantitatively.
- Bitumen materials will be procured from foreign countries because local procurement is not possible completely.
- Bridge construction materials such as PC steel materials, steel pipes, cables, bearing and expansion devices will be procured from foreign countries because local procurement is not possible completely.
- General construction equipment such as backhoe and 50 ton crane are available for local procurement. However, equipment such as crane more than 100 tonne and benoto boring equipment will be procured form foreign countries.
- Some major construction companies in Ghana are adequate abilities as a subcontractor of roads and bridges projects since they have many experiences of road construction works.

(5) Implementation Schedule

- Construction of sections is divided three as shown in Table-6.

Table-6 Construction of Sections

Section	Starting Point	Ending Point	Length (km)
Section 1	Asutsuare Jct.	Volivo	28.30
Section 2	Bridge across the Volta River		0.52
Section 3	Dufor Adidome	Asikuma Jct.	38.40
Total			67.22

Source: Study Team

- Overall implementation schedule for construction of road between Asutsuare Jct. and Asikuma Jct. is proposed, considering ordering of three sections at the same time.

8. Preliminary Design for Upgrading of Asutsuare – Aveyime Road

(1) Justification of Upgraing of Asutsuare – Aveyime Road

With positive impacts; 1) to connect the Green Belt are of Ghana, 2) to attract more investments for agricultural development along the road, and 3) to provice a direct access between the Eastern Corridor and N1 along the Volta River, the Study Team considered that carrying out the F/S for the upgrading of the Asutsuare – Aveyime road is justified.

(2) Preliminary Design of Road

a) Horizontal and Vertical Alignment

The design speed of this road, which lies entirely on flat terrain, was set at 80 km/h based on the Road Design Guide. The proposed horizontal alignment basically follows the centreline of the existing unpaved road, which has been confirmed by the GHA, not only for economic reasons but also to minimise the resettlement of houses and other commercial buildings, and to reduce the impact on

existing and future agricultural development schemes. The Study Team proposes that the design speed for such sections be decreased to 50 km/h or less.

- Design speed for normal sections: 80 km/h
- Design speed in Aveyime Township: 40 to 50 km/h
- Design speed in other townships: 50 km/h

b) Existing Cross Drainage Facilities to be Considered

There are several existing cross drainage facilities to be considered for the preliminary design for upgrading of the Asutsuare–Aveyime road.

c) Comparison of Horizontal Alignment

The Study Team compared the existing alignment (Alternative 1) and a bypass alignment (Alternative 2) around Volivo Township because it would be possible to construct a bypass route to south part of the township to avoid the residential area. Then, the Study Team recommends a bypass alignment (Alternative 2).

d) Pavement Design

The pavement thickness shown in Table-7 is recommended for the pavement thickness for economic reasons as well as greater durability against the weather thanks to its higher impermeability and strength of sub-base course.

Table-7 Recommended Pavement Thickness for the Asutsuare–Aveyime Road

Item	Pavement Thickness
Asphalt Concrete Wearing	5cm
Asphalt Concrete Binder	5cm
Base Course	35cm
Sub-base Course	71cm
SN	7.10 > 7.04…OK
Cost	US$ 47.40 /m^2

Note: Pavement composition was calculated based on the results of the resilient module test, due to the existing road section.
Source: Study Team

e) Road Drainage

The inner sizes of planned facilities such as road culverts are determined taking into account the following:

- Compare the inner sizes of existing facilities with the minimum requirement of facilities, and then adopt the planned facilities.

Secure an inner size of planned box culverts of at least B1.0 H1.0 and planned pipe culverts of at least D900 considering efficiency of maintenance works.

f) Intersection Design

The Volivo Intersection is a new intersection with four arms where the Eastern Corridor and the Asutsuare–Aveyime road cross. The new Volivo Intersection will be opened to traffic in 2016. Thus, it is recommended to introduce roundabout at this intersection for ensuring proper traffic handling.

g) Traffic Safety and Management

- Appropriate pavement markings are provided to control traffic movement, and to warn and guide motorists and pedestrians. Danger warning signs, regulatory signs and information signs are placed in appropriate locations.
- In large settlements where pedestrians cross the road, apart from the mandatory speed limit sign of 50 km/h, pedestrian crossing points are indicated by zebra stripes and signs.
- Bus bays are provided along the proposed road where necessary.

(3) Implementation Programme for Upgrading of Asutsuare – Aveyime Road

- Implementation of major works such as earth works and pavement works should be considered to avoid rainy season.
- It is recommended to use hot weather concrete in aspects of quality management of concrete works.
- It is required to secure proper traffic during under construction by providing detours
- Relocation and removal of the existing electric poles and lines are needed if electric poles are within the road width.

(4) Implementation Schedule

- Total road length is 24.1 km, which is no needed to divide sections. Implementation schedule is considered construction period of 21 months.

9. Preliminary Cost Estimation

As this Chapter includes information related to the tender process, it will not be made public until the tender process is completed.

10. Economic Analysis

(1) Methodology for Economic Analysis

- In order to analyse the economic feasibilities of the projects, the economic analysis was conducted by using the "Highway Development and Management model (HDM-4)", which was produced by the World Bank (WB) and is widely used for economic evaluation and other studies to support decision-making by implementing agencies. This model is based on a comparison of costs and benefits under two scenarios: "With the project" and "Without the project". All costs and benefits are valued in monetary terms and expressed in economic prices. The results are expressed in terms of Economic Internal Rate of Return (EIRR) and Net Present Value (NPV).
- The opportunity cost of capital, which is used as the cut-off ratio to judge the economic viability of projects and as the discount rate to calculate NPV, is set at 12.0% in accordance with the indication by the WB.

Table-8 Estimated Project Cost of Construction of Road between Asutsuare Jct. and Asikuma Jct. (Eastern Corridor)

Item	Foreign Portion US$ (1000)	Local Portion GHS (1000)	Total US$ (1000)
Section 1 (Asutsuare Jct. – Volivo: 28.3 km)			
1. Construction Cost	24,338	31,023	44,883
2. Consulting Services	2,925	3,454	5,212
3. Land Acquisition and Compensation	-	2,972	1,968
4. Other Costs*	5,592	16,564	14,431
Total Project Cost	32,855	54,013	66,494
Section 2 (Bridge across the Volta River: 520 m)			
1. Construction Cost	62,541	9,347	68,731
2. Consulting Services	4,563	5,388	8,131
3. Land Acquisition and Compensation	-	-	-
4. Other Costs*	8,724	25,840	22,513
Total Project Cost	76,828	40,575	99,375
Section 3 (Dufor Adidome – Asikuma Jct.: 38.4 km)			
1. Construction Cost	35,021	43,645	63,925
2. Consulting Services	4,212	4,974	7,506
3. Land Acquisition and Compensation	-	4,033	2,671
4. Other Costs*	8,053	23,852	20,781
Total Project Cost	47,286	76,504	94,883
Whole Section	155,969	171,091	260,752

Note: * Other costs include price escalation, physical contingency, administration cost, VAT, import tax, interest during construction, and commitment charge.

Source: Study Team

Table-9 Estimated Project Cost of Upgrading of Asutsuare – Aveyime Road

Item	Foreign Portion (US$ thousand)	Local Portion (GHS thousand)	Total (US$ thousand)
1. Construction Cost	10,514	13,998	19,784
2. Consulting Services	2,281	3,219	4,413
3. Land Acquisition and Compensation	-	1,239	820
4. Other Costs*	1,885	8,067	7,228
Total Project Cost	14,680	26,523	32,245

Note: * Other costs include price escalation, physical contingency, administration cost, VAT, import tax, interest during construction, and commitment charge.

Source: Study Team

Table-10 Estimated Maintenance Cost

Section		Routine Maintenance	Periodic Repairs	Periodic Inspection of Bridges	Total	
			For Twenty Years	Every 5 years	US$ 1,000	GHS 1,000
Asutuare Jct. –Asikuma Jct.						
Section 1	Asutsuare–Volivo	418,496	29,515,360	7,658	29,942	56,290
Section 2	Volivo–Dufor Adidome (New Volta Bridge)	-	-	50,027	50	94
Section 3	Dufor Adidome–Asikuma	575,432	40,583,620	7,658	41,167	77,393
Total		993,927	70,098,980	65,343	71,158	133,778
Asutsuare–Aveyime road		768,678	12,807,557	-	13,576	25,523

Source: Study Team

- In the Study, those quantitative benefits were defined as 1) Savings in Road User Costs, 2) Savings in Maintenance Costs and 3) Induction of agricultural development, while costs were 1) Project Costs and 2) Increase in Maintenance Costs. Note that maintenance costs on some section are expected to increase and those on the other section decrease.

(2) Assumption and Calibration

- The analysis period of the projects was determined to be 20 years plus the construction period of the respective projects. Both roads are assumed to be opened to traffic in 2016 following the construction period of three and two years.
- Pavement and traffic conditions are affected by many factors such as climate and traffic loading. Therefore, calibration was done to identify actual conditions in Ghana.
- The characteristics of traffic on the proposed new Eastern Corridor were identified. This traffic is mostly generated by the diversion of heavy vehicles from the central corridor and the R28 route via N1 as well as the diversion of light vehicles from the Asutsuare – Asikuma section on the existing Eastern Corridor in addition to the two routes.
- The road network used for the analysis is the Asutsuare – Aveyime section with a length of around 24 km. The study investigated the difference in benefits and costs caused by upgrading the road surface from gravel to asphalt pavement.
- The target land for agricultural development induced by construction of the proposed new road between Asutsuare Jct. and Asikuma Jct was determined to be 25,000 ha.

(3) Results of Economic Analysis

a) New Construction of the Proposed New Road between Asutsuare Jct. and Asikuma Jct.

- The EIRR including agricultural development benefit is determined to be 23.0% while the EIRR without the benefit is 16.7%, both of which exceed the cut-off ratio of 12%. The Net Present Value (NPV) of the project, which is the monetary value of the net costs subtracted from the net benefits, is estimated to be US$ 210.95 million at a discount rate of 12%.
- Impact on EIRR by variation in project cost by the sensitivity analysis is slightly stronger than that in road user costs, the extent of which is -2.5% ~ +3.3%. In combined case, the EIRR of the worst scenario is 18.8% and that of the best scenario is 28.2% while the base case is 23.0%. The EIRRs without agricultural development benefits changes from 12.9% to 21.2% in combined case while the base case is 16.7%.

b) Upgrading on Asutsuare – Aveyime Road

- The significant decrease in road user cost is expected due to the difference of road surface roughness. The roughness on the upgraded paved road fluctuated between 2 and 4 in International Roughness Index (IRI) while that on un-upgraded gravel road was from 18 to 21. The EIRR of the project was estimated to be 52.2% over the cut-off ratio of 12%. The NPV at 12% was US$68.30 million.

- In combined case by the sensitivity analysis, the difference was between -14.9% and +19.5% under this study scenario while the base case is 52.2%. However EIRRs in all cases are far beyond the cut-off ratio of 12%.

11. Environmental and Social Considerations

(1) Legal Framework for Environmental and Social Considerations

The legal framework for environmental and social considerations in Ghana is well developed. However, due to active customary laws, special care is needed to understand the "enforcement of common laws" and customary practices, especially concerning land management. The chieftaincy and its land management are still common in Ghana, especially in rural areas. Because this customary land management is based on trust among a community and surrounding communities, there are no official titles in many cases. In the case of land acquisition, buyers must pay attention to not only legal ownership and rights of use but also customary owners (mostly chiefs) and customary users. In many cases, no official land titles are available, so it is highly recommended for outsiders or foreigners to have a local expert handle such customary matters.

Considering the environmental and social policy frameworks for the proposed road development and improvement projects, the GHA is likely to apply the MRHs' environmental and social management framework (ESMF) and resettlement policy framework (RPF). Both frameworks were originally developed for the TSDP financed by the WB in 2007. Both the ESMF and RPF are principal environmental and social consideration policies for any agency under the MRH. Since both the TSDP and RPF were developed based on the WB's operational policies in addition to Ghanaian legislation, the principal policies are identical to JICA's guidelines for environmental and social considerations. Thus, it is reasonable to apply the ESMF and RPF for the proposed road projects.

(2) Major Findings of the Environmental Impact Assessment of the Proposed Project

An IEE-level environmental impact assessment was conducted to clarify the environmental and social baseline of the proposed project sites and assess the potential impacts of the projects. Though the proposed projects are located adjacent to two natural reserve areas, the environmental conditions of the proposed projects are commonly used farm-land, cattle fields, or degraded bush or wood-land. Based on the references and field surveys, no sensitive area would be affected by the proposed projects.

Regarding the negative impacts on the natural environment, no significant impacts are expected for any of the environmental and social consideration items. Major negative impacts of the proposed projects would be temporary air pollution, soil contamination, and water contamination from the construction activities. As the geology along the proposed alignment is moderate, no significant earthwork is expected. The extent of all impacts would be minimal or limited in extent.

Regarding the positive impacts on the natural environment, improvement of air quality at the operation stage for upgrading of the Asutsuare–Aveyime road would be the only positive impact. Due to the rough gravel road at present, a clean paved road would greatly reduce the dust in the air.

Regarding the negative impacts on the social environment, no significant impacts are expected from

the proposed projects. The major negative impacts would be involuntary resettlement including farmland and commercial land and cemetery acquisition. None of the farmland owners would be required to relocate. A summary of the expected impacts for are shown below.

Regarding the positive impacts on the social environment, improvement of the social infrastructure and services as well as land-scape would be significant positive impacts. During the operation phase, the bridge would be a new land mark of the project site, which is likely to become a new tourist attraction and lead to related businesses. The proposed projects are likely to attract agricultural investment into the region. Though not only resulting from the proposed road projects, the regional demand for skilled/unskilled labours is likely to support new agribusinesses through the new transport network.

As a part of the EIA process, the GHA hosted two public consultations at the project-affected area. There were no objections to the projects: rather, there was high anticipation toward participating in the projects.

(3) Overall Recommendation from the Environmental and Social Considerations

The IEE-level assessment found that the proposed projects are reasonable and recommended for a Japanese ODA loan project. However, it is highly recommended to address the following points during the next detailed design stage.

a) Assurance and Enforcement of Budget for Resettlement

Throughout the hearing at the land commission and public consultations, many stakeholders repeatedly mentioned incomplete compensation by the GHA or other public agencies due to the lack of funding at the beginning of a project and continuous shortage of funding. Though legal frameworks and safeguard policies are well implemented in the GHA, sufficient budget is the key to accomplishing such duties. Thus, it is highly recommended to monitor the enforcement of the budget regarding environmental and social consideration matters.

b) Assurance for Environmental Services

The GHA has three in-house environmental officers in total, all of whom are unlikely to be able to concentrate on one project. Those three officers need to cover all environmental related duties under the GHA throughout the nation. In order to ensure tightly-controlled EIA processes, it is highly recommended to continuously assist the GHA's environmental officers by a set of Japanese environmental expert and local environmental experts in the following stage.

12. Overall Evaluation

The Study Team has analysed feasibility of two projects, 1) construction of road between Asutsuare Jct. and Asikuma Jct., and 2) upgrading of Asutsuare – Aveyime road from the technical, economical, regional development, environmental and social consideration points of view.

As a results, both projects are identified as feasible for the implementation at an early stage.

13. Conclusions and Recommendations

(1) Conclusions

- Based on the results of the Study, the Study Team prepared several alternative road alignments for the development of a part of the Eastern Corridor between Asutsuare Jct. and Asikuma Jct., together with four possible locations for alternative bridge sites.
- The Study Team presented these alternatives with the results of a first screening evaluation to the working group meeting in the GHA, and four alternative routes in the south of the Volta River and one alternative route in the north of the Volta River were selected for further study in the first phase of the Study.
- The first Workshop was held on 18th May 2012, inviting various stakeholders to discuss the priorities of alternative routes for selecting the highest priority route. However, the Workshop was unable to select a particular alternative for the F/S.
- After discussion with the Study Team as well as in the internal meetings, the GHA selected Alternative 4 as the highest priority route for the preliminary design in the second phase of the Study.
- Based on the selected route for the F/S, the Study Team carried out more detailed natural condition surveys, and carry out the preliminary design and cost estimation for construction of road between Asutsuare Jct. and Asikuma Jct., including a new bridge across the Volta River.
- At the same time, the Study Team also carried out the preliminary design and cost estimation for upgrading Asutsuare – Aveyime road, which will be converted from feeder road to an inter-regional road.
- The Study Team, then, carried out the economic analysis of above mentioned two projects, using HDM IV model. Results of economic analysis indicate that construction and upgrading of both projects are technically and economically feasible.
- These two projects will also contribute to the regional development, particularly for the agriculture sector.
- The Study Team also supported GHA to hold two public consultation meetings at Asutsuare and Juapong and there was no objection for the project plan in these meetings.
- The second Workshop was held on 26th October 2012, inviting various stakeholders to discuss the contents of the Draft Final Report and some comments were made by the participants. These comments were reflected in preparing the Final Report.
- The GHA carried out the Road Safety Audit and minor modifications of road design were recommended. Thus, the Study Team modified the road design according to these recommendations.

(2) Execution, Operation and Maintenance of the Project

- It is desirable that the GHA would be an executing agency of the Project, because of construction of long bridge across the Volta River, as well as new construction of 67 km of road.

- In order to carry out effective and adequate maintenance on the Project roads, the Study Team recommends that the GHA outsource O&M to private enterprises with resources from the Road Fund. The priority of routine and periodic maintenance should be identified by using the road database system of the GHA.

(3) Recommendations

- It is recommended for the MRH and the GHA to share the outcome of the Study with development partners for the possible financial assistance for the Project.
- When the financial source is determined, the GHA should carry out the EIA to obtain the environmental permit and to start land acquisition to secure ROW.
- For the construction of the new bridge across the Volta River, the GHA should establish a special bridge unit to supervise the long span cable stayed bridge, which will be the first experience in Ghana and to transfer technology of long span bridge construction to Ghanian engineers.
- The GHA should improve the Asutsuare – Akuse Jct. and Aveyime – Tefle (N1) prior to upgrade of Asutsuare – Aveyime road to ensure the maximum utilization of the Project road.
- It is recommended for the GoG to carry out traffic safety education in schools and communities in order to teach local residents, particularly pupils and elderly people, about the dangers associated with high-speed vehicles which will pass through their communities.

TABLE OF CONTENTS

CHAPTER 13 CONCLUSIONS AND RECOMMENDATIONS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviation	Full Name
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
AEAs	Agriculture Extension Agents
AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
APGIP	Accra Plains Gravity Irrigation Project
BADEA	Arab Bank for Economic Development in Africa
BP	Border Post
BRT	Bus Rapid Transit
BST	Bitumen Surface Treatment
CBOs	Community-Based Organisations
CBR	California Bearing Ratio
CBRDP	Community Based Rural Development Project
CEPS	Customs Excise and Preventive Services
CIF	Cost, Insurance and Freight
CVR	Commercial Vehicles Ratio
DA	District Assembly
DAAS	District Centres for Agricultural Advisory Services
DACF	District Assemblies' Common Fund
DANIDA	Danish International Development Agency
DDF	District Development Facility
DFR	Department of Feeder Road
DP	Development Policy
DUR	Department of Urban Roads
DVLA	Driver and Vehicle Licensing Agency
ECOWAS	Economic Community of West African States
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EITI	Extractive Industries Transparency Initiative
EMP	Environmental Management Plan
EP	Environmental Permit
EPA	Environmental Protection Agency
EPA	Extension Planning Area
ESIA	Environmental and Social Impact Assessment
ESAL	Equivalent Single Axle Load
ESMF	Environmental and Social Management Framework
EU	European Union
FAO	Food and Agriculture Organization
FASDEP	Food and Agriculture Sector Development Policy
FBO	Farmer-Based Organisations
FDI	Foreign Direct Investment
FLEGT	Forest Law Enforcement, Governance and Trade
FOB	Free On Board
FRI	Food Research Institute
GAP/HACCP	Good Agricultural Practices / Hazard Analysis and Critical Control Points
GDP	Gross Domestic Product
GEPC	Ghana Export Promotion Council

Abbreviation	Full Name
GHA	Ghana Highway Authority
GHS	Ghana Cedi
GIDA	Ghana Irrigation Development Authority
GIS	Geographic Information System
GMA	Ghana Maritime Authority
GoG	Government of Ghana
GPHA	Ghana Ports and Harbours Authority
GPRS I	Ghana Poverty Reduction Strategy
GPRS II	Growth and Poverty Reduction Strategy
GRCL	Ghana Railway Company Limited
GRDA	Ghana Railway Development Authority
GRFS	Ghana Road Fund Secretariat
GSGDA	Ghana Shared Growth Development Agenda
GSS	Ghana Statistical Service
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit (German Technical Co-operation)
GUTP	Ghana Urban Transport Project
ha	Hectare
HACCP	Hazard Analysis and Critical Control Points
HDM-4	Highway Development and Management Model 4
HIV	Human Immunodeficiency Virus
ICD	Inland Container Depot
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IRI	International Roughness Index
IT	Information Technology
Jct.	Junction
JFFLS	Junior Farm Field and Life Schools
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
KIS	Kpong Irrigation Scheme
KLBIP	Kpong Left Bank Irrigation Project
LCP	local currency portion
LDC	Less Developed Country
LEF	Load Equivalency Factor
LI1652	Environmental Assessment Regulations LI1652, 1999
LL	Liquid limit
LSDGP	Local Service Delivery and Governance Programme
LUS	Lesser Used Species
MA	MA -Municipal Assembly
MASLOC	MASLOC -Macro Finance and Small Loan Centre
MCA	MCA -Millennium Challenge Account
MCC	Millennium Challenge Corporation
MCC	Manual Classified Counts
MDG	Millennium Development Goals
MiDA	Millennium Development Authority
MMDAs	Metropolitan, Municipal, and District Assemblies
MEST	Ministry of Environment, Science and Technology
MoFA	Ministry of Food and Agriculture
MoFEP	Ministry of Finance and Economic Planning
MoLGRD	Ministry of Local Government and Rural Development
MRH	Ministry of Roads and Highways

Abbreviation	Full Name
MRH	Ministry of Roads and Highways
MoT	Ministry of Tourism
MoTI	Ministry of Trade & Industry
MoTr	Ministry of Transport
MT	Metric Tonnes
MTDP	Medium Term National Development Plan
MTEF	Medium Term Expenditure Framework
MW	Mega Watt
NBSSI	National Board for Small Scale Industries
NDIS	New Development Irrigation Scheme
NDPC	National Development Planning Commission
NGO	Non-Governmental Organizations
NPV	Net Present Value
NRSC	National Road Safety Commission
NTDPSP	National Tourism Development Policy and Structural Plan
NTP	National Transport Policy
O/D	Origin and Destination
ODA	Official Development Assistance
OP	Operational Policies
ORIO	Facility for Infrastructure Development
PAP	Project Affected People
PC	Prestressed Concrete
PCU	Passenger Car Unit
PEA	Preliminary Environmental Assessment
PL	Plastic limit
POCC	Potential Opportunity, Constrains and Challenges
PPP	Public-Private Partnership
PPP	Purchasing Power Parity
PPR	Pest de Petit Ruminant
PPRSD	Plant Protection and Regulatory Services Directorate
PSDS	Private Sector Development Strategy
PSI	President's Special Initiative
RAP	Resettlement Action Plan
RC	Reinforced Concrete
RCC	Regional Coordinating Council
RDP	Regional Development Plan
REDD+	Reducing Emission from Deforestation and Forest Degradation plus
ROW	Right of Way
RPF	Resettlement Policy Framework
RSDP	Road Sector Development Programme
SCF	Standard Conversion Factor
SEA	Strategic Environmental Assessment
SLM	Sustainable Land Management
SMTDP	Sector Medium-Term Development Plan
SPS	Sanitary and Phytosanitary
SPT	Standard Penetration Test
SRID	Statistics, Research and Information. Directorate, MoFA
STI	Science, Technology and Innovation
TCC	Travel Time Cost
TEU	Twenty-feet Equivalent Unit
TSDP	Transport Sector Development Programme
UK	United Kingdom
UN	United Nations

Abbreviation	Full Name
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
US$	United States Dollar
VAT	Value Added Tax
VLTC	Volta Lake Transport Company
VOC	Vehicle Operating Costs
VPA	Voluntary Partnership Agreement
vpd	vehicles per day
VRA	Volta River Authority
WB	World Bank
WGM	Working Group Meeting

CHAPTER 1
INTRODUCTION

Chapter 1 Introduction

1.1 Background of the Study

Ghana, located on the West Coast of Africa, is bordered by the Gulf of Guinea in the south, Togo in the East, Cote d'Ivoire in the West, and Burkina Faso in the north. The country has been playing a leading role in West Africa since gaining independence in 1957. Ghana has a population of approximately 25 million (United Nations Development Program (UNDP), 2011) and a land area of 238,537 km^2.

Under Ghana's vision 2020, a strategic national economic policy, the economy has grown in recent times underpinned by a relatively sound economic management, a growing competitive business environment and improving social and economic infrastructure. The country is endowed with a number of natural resources with agriculture accounting for 25% of Gross Domestic Product (GDP) and employing about 50% of the active work force. Gold, cocoa, timber, diamonds, and bauxite are major sources of foreign exchange. In recent times, oil production which began in December 2010 has also helped sustain economic growth. The nation's Gross National Income (GNI) now stands at US$ 1,230 per capita (World Bank (WB), 2010).

The volume of international cargo handled by Ghana for its neighbouring landlocked countries has been increasing. There are however problems such as chronic congestion and deteriorating roads in and around Accra, the capital city, and Kumasi, the second largest city, since the two transit routes which are of international standard - the Central Corridor (N6) running north-south and the Coastal Road (N1) running east-west pass through these major cities. A possible alternative international transit route to Burkina Faso is the Eastern Corridor (N2). The Eastern Corridor which lies to the east of the country, and approximately 695 km in total length connects Tema to Kulungugu in the northernmost part 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 Government of Ghana (GoG) has put a high priority on developing the Eastern Corridor under the Road Sector Medium-Term Development Plan and is actively promoting the development of this route. The development of the Eastern Corridor is expected to contribute to the economic revitalization and the reduction of poverty in the area along the corridor and the neighbouring countries by reducing traffic congestion and facilitating regional trade.

Based on a request from the GoG for support for a targeted section of the Eastern Corridor development project, the Ministry of Roads and Highways (MRH), the Ghana Highway Authority (GHA) and the Japan International Cooperation Agency (JICA) have had a series of discussions on the project. As a result of the discussions, the Ghanaian side and JICA agreed to carry out a preparatory study to confirm the feasibility of the project. JICA subsequently

dispatched a JICA mission for the preparatory survey of the project.

1.2 Objectives of the Study

The objectives of the study are as follows:

(1) To select the optimum route, with a new bridge across the Volta River, among alternative routes between Asutsuare Junction (Jct.) and Asikuma Jct. on the Eastern Corridor (N2), and to confirm the viability of the road and bridge development project.

(2) To confirm the viability of the road development project between Aveyime and Asutsuare.

1.3 Study Area

The Study Area is in the Volta, Eastern and Greater Accra Regions (see Figure 1-1). Even though the project roads are located between Asutsuare Jct. and Asikuma Jct., and Asutsuare and Aveyime, the Study Area covers a larger area in those three regions in terms of transport planning. In addition, the whole of Ghana is also considered as the Study Area for traffic forecasting, because traffic is expected to divert from the Central Corridor when the whole of the Eastern Corridor becomes functional in the near future.

1.4 Scope of the Study

The Study Team has been carrying out the Study as detailed in the flowchart of Figure 1-2.

1.4.1 Work Items Completed

The Study Team has completed the following work items since the Study commenced in March 2012.

(1) Preparatory Works

[101] Preparation of Inception Report

(2) Study of Basic Site Conditions

[201] Submission and Discussion of Inception Report

[202] Confirmation of Justification of Project

[203] Observation of Site Conditions

[204] Survey related to Regional Development

[205] Environmental and Social Consideration Survey (1)

[206] Traffic Surveys and Future Traffic Demand Forecasts

[207] Natural Condition Surveys (1) (Completed)

- Hydrological survey (Volta River, influent rivers, irrigation channels and swamps)
- Geotechnical investigation: Boring surveys at two locations
- Bathymetric survey at possible bridge locations

Note: District boundaries may not reflect the latest revision of district boundaries by the GoG.
Source: Study Team

Figure 1-1 Study Area

- Meteorological survey
- Seismic investigation

[208] Preliminary Project Route Study

[209] Study of Bridge Location and Type

[210] Rough Estimation of Construction Costs

[211] Comparison of Alternative Routes for Project

[212] 1st Workshop

[213] Preparation of Interim Report

(3) Preliminary Design and Evaluation of Project

[301] Explanation of Interim Report

[302] Natural Condition Surveys (2)

- Topographical survey
- Geotechnical investigation

[303] Preliminary Design of Roads and Bridges

[304] Environmental and Social Consideration Survey (2)

[303] Preliminary Design of Roads and Bridges

[304] Environmental and Social Consideration Survey (2)

[305] Preparation of Construction Plan

[306] Preliminary Estimation of Project Cost

[307] Preparation of Project Implementation Programme

[308] Evaluation of Projects

[309] Preparation of Execution Scheme, and Operation and Maintenance Programme

[310] Presentation of Necessary Items for Project Financed by Yen Loan

[311] Considerations for Reducing Project Cost

(4) Preparation of Final Report

[401] Preparation of Draft Final Report

[402] Explanation of Draft Final Report

[403] 2nd Workshop

[404] Preparation of Final Report

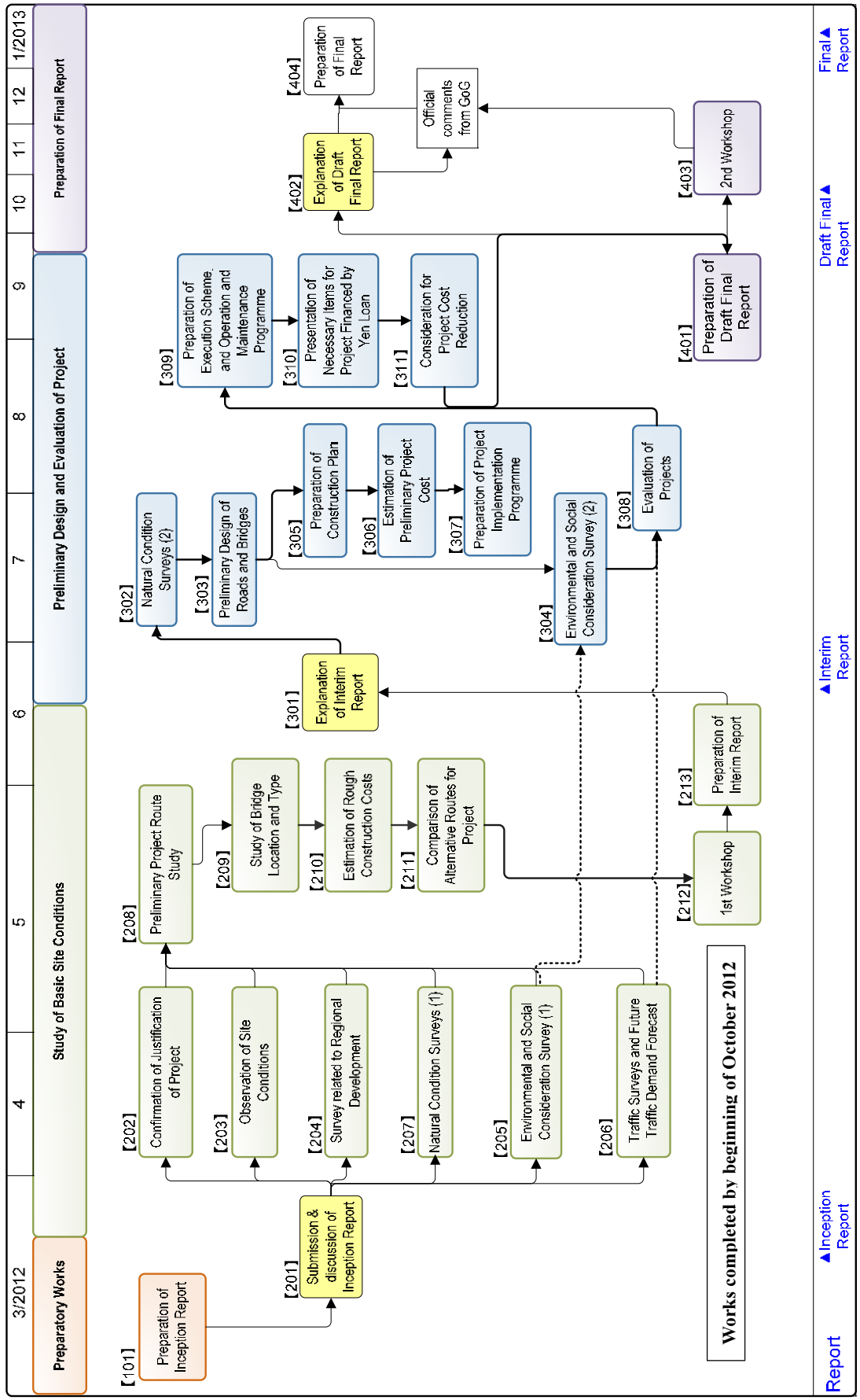


Figure 1-2 Work Flowchart

Source: Study Team

1.5 Study Organisation

The Study Team carried out the Study in close collaboration with related officials and counterpart personnel of the GHA.

1.5.1 Study Team Members

The Study Team members are listed in Table 1-1.

Table 1-1 Study Team Member

Name	Responsibility
Mr. Hikaru Nishimura	Team Leader/Road Planning
Mr. Shigeru Ando	Road Design
Mr. Makoto Itoi	Bridge Design I
Mr. Noriaki Ebii	Bridge Design II (First Stage)
Mr. Hisao Takada	Bridge Design II (Second Stage)
Mr. Nobuo Kashiwazaki	Natural Condition Survey I
Mr. Shinya Toyosaki	Natural Condition Survey II
Mr. Shinya Nagaoka	Environmental and Social Considerations
Mr. Katsuyuki Oono	Construction Planning/Cost Estimation
Mr. Tomomi Fujita	Regional Development Planning/Project Coordination
Mr. Kiminari Tachiyama	Traffic Planning I/Economic Analyses
Mr. Seiji Kadooka	Traffic Planning II

Source: Study Team

1.5.2 List of Officials and Counterpart Personnel of GHA related to the Study

Table 1-2 shows the list of officials and counterpart personnel of GHA who worked closely with the Study Team on this Study.

Table 1-2 List of Officials and Counterpart Personnel of GHA related to the Study

Name	Position and Responsibility
Mr. Joseph Atsu Amedzake	Director of Planning, GHA
Mr. Owusu Sekyere Antwi	Director of Bridges, GHA
Mr. Ebenezer Mills	Director of Survey & Design, GHA
Mr. Joe Fred Peseo	Director of Road Safety & Environment, GHA
Mr. Victor Owusu	Director of Road Safety & Environment, GHA
Mr. John Acquah	[C/P for Economic Evaluation], Transport Planning Economist, Planning Division, GHA
Miss. Winifred Eugenia Turkson	[C/P for Bridges], Bridge Engineer, Bridge Division, GHA
Mr. Bernard Owusu	[C/P for Roads], Design Engineer, Survey & Design Division, GHA
Mrs. Rita Ohene-Sarfo	[C/P for the Environment], Chief Engineer, Road Safety & Environment Division, GHA

Source: Study Team

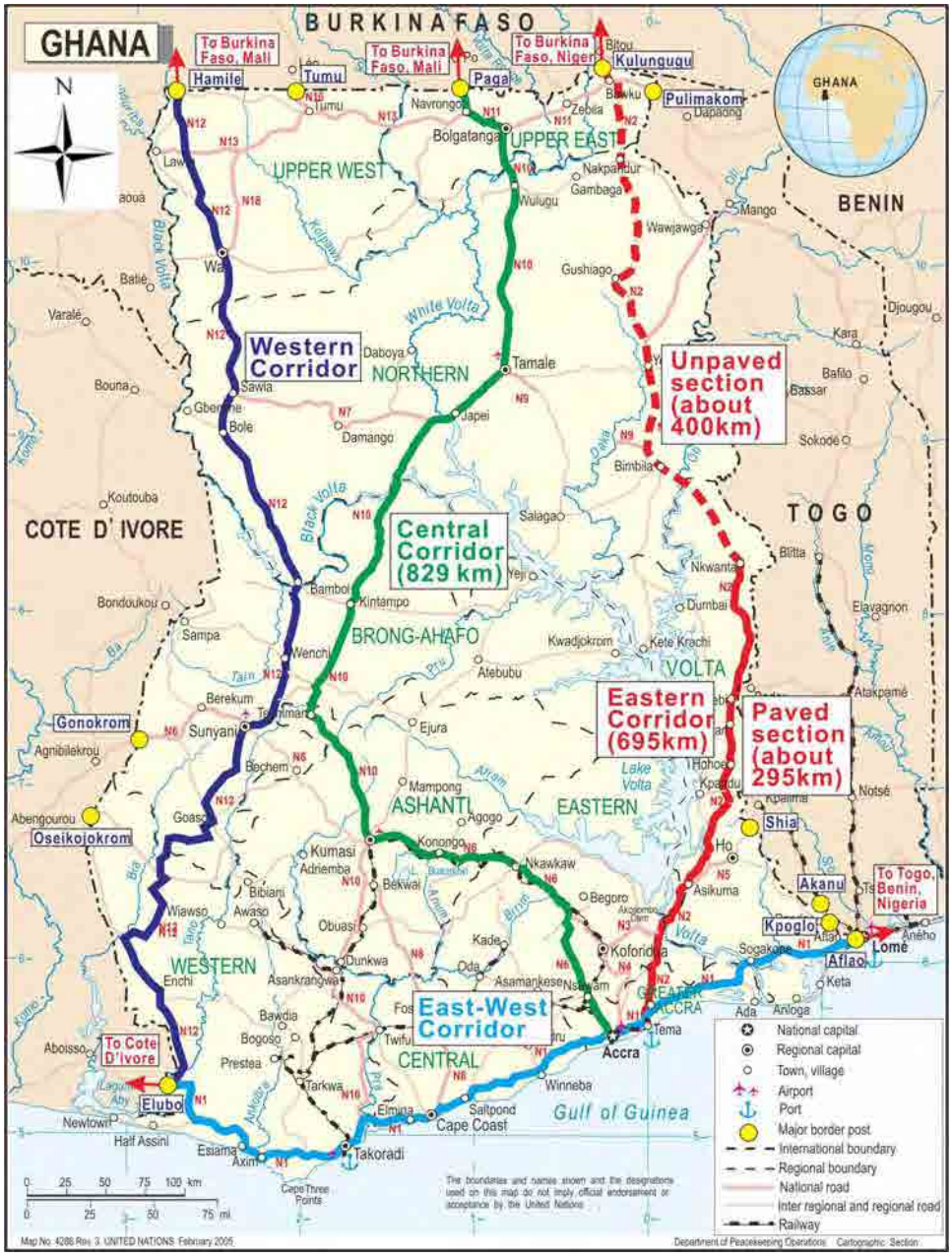
CHAPTER 2

OUTLINE OF THE STUDY AREA

Chapter 2 Outline of the Study Area

2.1 Definition of the Eastern Corridor

The Eastern Corridor is defined as National Road N2 connecting Tema Port and the Kulungugu Border Post (BP) with Burkina Faso. The length of the Eastern Corridor is 695 km, of which about 400 km is unpaved road. Almost all traffic, particularly cargo vehicles to/from Burkina Faso, Mali and Niger mainly uses the Central and a section of the Western Corridors, i.e., Sunyani – Hamila section, even though there are longer. Figure 2-1 shows the locations of the present transport corridors and major border posts.



Source: Study Team

Figure 2-1 Major Transport Corridors and Border Posts

2.2 Regional Coordination Programme

In the Western Africa region, there is regional coordination by the Economic Community of West African States (ECOWAS). The ECOWAS Treaty was adopted by 18 countries in 1975 and revised in 1991. The revised Treaty defines the coordination programme for the transport, communications and tourism sectors as follows:

ARTICLE 32 TRANSPORT AND COMMUNICATIONS

1. For the purpose of ensuring the harmonious integration of the physical infrastructures of Member States and the promotion and facilitation of the movement of persons, goods and services within the Community, Member States undertake to:
   a) evolve common transport and communications policies, laws and regulations;
   b) develop an extensive network of all-weather highways within the Community, priority being given to the inter-State highways;
   c) formulate plans for the improvement and integration of railway and road networks in the region;
   d) formulate programmes for the improvement of coastal shipping services and inter-state inland waterways and the harmonisation of policies on maritime transport and services;
   e) co-ordinate their positions in international negotiations in the area of maritime transport;
   f) encourage co-operation in flight-scheduling, leasing of aircraft and granting and joint use of fifth freedom rights to airlines of the region;
   g) promote the development of regional air transportation services and endeavour to bring about the merger of national airlines in order to promote their efficiency and profitability;
   h) facilitate the development of human resources through the harmonisation and coordination of their national training programmes and policies in the area of transportation in general and air transport in particular;
   i) endeavour to standardise equipment used in transport and communications and establish common facilities for production, maintenance and repair.
2. Member States also undertake to encourage the establishment and promotion of joint ventures and Community enterprises and the participation of the private sector in the areas of transport and communications.

Source: ECOWAS website - http://www.comm.ecowas.int/sec/index.php?id=treaty&lang=en, April 2012

2.3 Social Conditions in Ghana and the Study Area

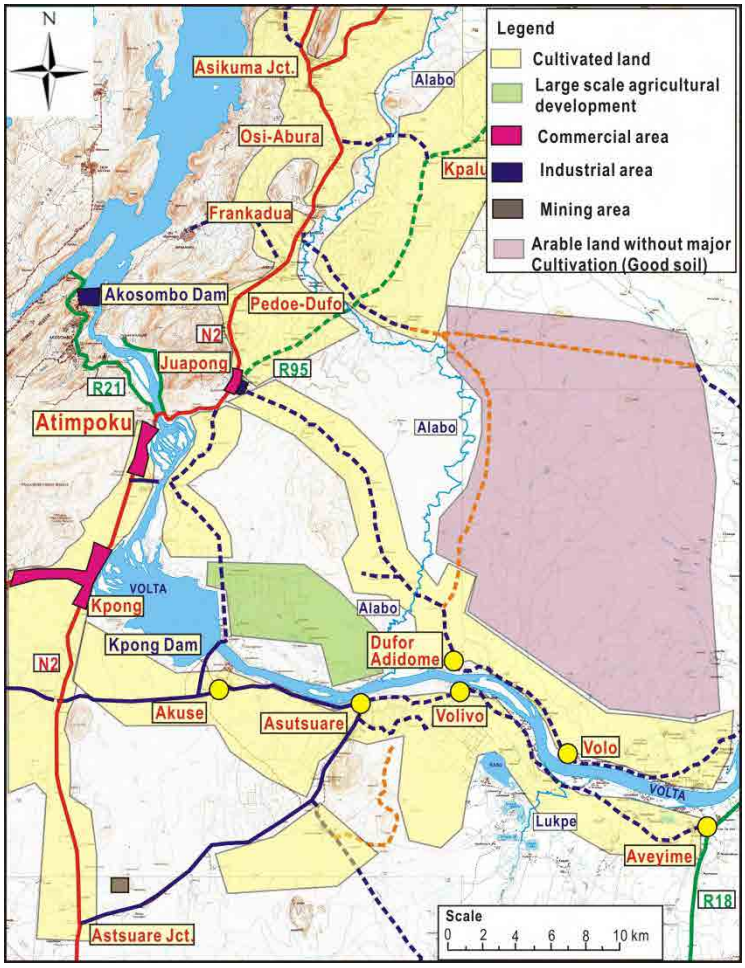
2.3.1 Land Use in the Study Area

(1) Land Use in the Study Area

Land use in the Study Area is mainly agricultural, consisting of the Accra Plain with

widespread cultivation of paddy, maize, oil palm, banana, cassava and yam. In the southern part of the Volta River, medium- and large-scale paddy fields are cultivated and a large-scale banana plantation is in operation, using the irrigation scheme from the Kpong Dam reservoir which was constructed in 1980s. On the other hand, large agricultural development projects are underway in the north-western part of the Volta River and private companies are planning to cultivate vegetables and maize. However, there is no medium- or large-scale cultivation in the north-eastern part of the Volta River, since there are neither access roads to transport products nor irrigation schemes. There is small-scale rain-fed cultivation of cassava, maize, oil palm and mango on the north side of the Alabo River.

There is a textile factory in Juapong, and there are commercial areas in Atimpoku and Kpong. There are two tourist sites: Akosombo (Akosombo Dam) in the north and Shai Hills in the south. The land use in the Study Area is shown in Figure 2-2. The land use pattern in each district related to the proposed roads in the Study is described below.



Source: Study Team

Figure 2-2 Land Use in the Study Area

(2) Land Use Pattern of Each District

a) Asuogyaman District (Eastern Region)

Asuogyaman District is located on both sides of the Lake Volta and the Volta River. Since Volta Hydroelectric Power Station is located in this district, land use includes an industrial area (power station), a commercial area at Atimpoku, a tourism area (Akosombo Dam and Lake Volta) and agricultural land. Since the terrain in Asuogyaman District is hilly and mountainous, maize, cassava, yam and plantain are mainly cultivated on a rain-fed basis.

b) Manya Krobo District (Eastern Region)

Manya Krobo District is located in the south of Asuogyaman District and east of the Kpong

Dam. As the district capital, Odumase, and two other major townships (Kpong and Agomanya) are nearby on the N3 starting from Kpong, Kpong has become a commercial centre of this district. Irrigation water from the Kpong Dam is available in the eastern part, so rice is cultivated. On the other hand, maize, cassava, yam and plantain are mainly cultivated in the hilly and mountainous parts of the district in the western part.

c) Dangme West (Greater Accra Region)

Dangme West District is a large district extending from the Volta River to the Gulf of Guinea. The northern part of the district is mainly agricultural use (paddy and banana) utilising irrigation, while the southern part, which has a relatively dry climate, is also agricultural, but with fruit and vegetable cultivation and cattle breeding. There are four natural reserves in the western part of the district and the Shai Hills is a famous tourist spot in Ghana. There is mining (quarry sites) on the north and south side of the Shai Hills.d) North Tongu (Volta Region)

North Tongu District is also a large district extending from the Volta River in the west to beyond R28 in the east, mainly on the north of the Volta River, but it also covers three major townships (Battor, Mepe and Aveyime) south of the Volta River. There are large paddy fields near Aveyime and Battor, and another large-scale paddy field area is being developed on the eastern side of Mepe. The rice produced in this area has the brand name of "Volta Rice" and is high quality. Other than this area south of the Volta River, land use is either rain-fed agriculture or unused, mainly due to lack of access roads to cultivation areas. Recently, the Ghana Irrigation Development Authority (GIDA) started the Kpong Left Bank Irrigation Project, a public-private partnership (PPP) financed by the Millennium Challenge Corporation (MCC), together with a Kenyan company, Vegpro Kenya Ltd., which plans to export vegetables (baby corn and chilli) to the U.K with a total development area of 3,000 ha. Also, an Israeli company, Pe-Aviv, has started a 5,000 ha. agricultural development project on the eastern side of the Kpong Left Bank Irrigation Project. On the other hand, the central part of North Tongu District is either unused land or used for small-scale cattle breeding, since there is no engineered feeder road.

e) Ho Municipality (Volta Region)

Only the south-western part of Ho Municipality along R95 is directly related to the Project Road, where rain-fed small-scale cultivation of maize, cassava and mango is carried out.

2.3.2 Demography

(1) Population and Population Density in Ghana

Population and housing censuses have been conducted regularly in Ghana by the Ghana Statistical Service (GSS) and the latest census was carried out in 2010, following the 2000 census. Table 2-1 shows population and population density by region in 2000 and 2010.

The average annual population growth rate in the whole country between 2000 and 2010 was 2.5%, while the Northern and Greater Accra Regions had higher growth rates. The population density of the whole country was 102 persons/km^2 in 2010, while three regions related to the

Study Area have equal or higher population densities.

Table 2-1 Population and Population Density by Region

Region	Area (km^2)	Population (persons)		Average Annual Growth Rate	Population Density in 2010 (person/km^2)
		2000	2010		
Western	23,921	1,924,577	2,325,597	1.9%	97
Central	9,826	1,593,823	2,107,209	2.8%	214
Greater Accra	3,245	2,905,726	3,909,764	3.0%	1,205
Volta	20,570	1,635,421	2,099,876	2.5%	102
Eastern	19,323	2,106,696	2,596,013	2.1%	134
Ashanti	24,389	3,612,950	4,725,046	2.7%	194
Brong Ahafo	39,557	1,815,408	2,282,128	2.3%	58
Northern	70,384	1,820,806	2,468,557	3.1%	35
Upper East	8,842	920,089	1,031,478	1.1%	117
Upper West	18,476	576,583	677,763	1.6%	37
Total	238,533	18,912,079	24,223,431	2.5%	102

Source: 2010 population and housing census, Provisional Report, GSS

(2) Population in the Study Area

The Study Area consists of three districts in the Eastern Region, two districts in the Greater Accra Region and four districts in the Volta Region. Table 2-2 shows the population by district in the Study Area, estimated by the Study Team. Note that the actual population in the Study Area is less than the total population shown in Table 2-2, as the Study Area covers only part of each district. In total, the average annual population growth rate in the Study Area is estimated as 2.5%, while the total population in the Study Area is almost 5% of the national total.

Table 2-2 Population by District in the Study Area

Region	District	Population		Average Annual Growth Rate
		2000	2010	
Eastern	Yilo Krobo	86,043	106,028	-
	Manya Krobo	154,301	190,140	-
	Asuogyaman	75,920	93,554	-
Greater Accra	Dangme West	96,809	130,260	-
	Dangme East	93,112	125,286	-
Volta	South Tongu	64,811	83,217	-
	North Tongu	130,388	167,418	-
	Adaku-Anygbe	51,409	66,009	-
	Ho	183,922	236,155	-
Total		938,715	1,200,077	2.5%

Source: Estimated by the Study Team based on 2010 population and housing census, Provisional Report, GSS

2.3.3 Poverty Ratio

The GoG and prepared the Growth and Poverty Reduction Strategy (GPRS-II) 2006–2009 in November 2005, which was the last poverty reduction strategy. Since the last GPRS-II, the GoG has been preparing the Medium Term Expenditure Framework (MTEF) to achieve the poverty reduction targets.

Table 2-3 shows the poverty headcount ratio in Ghana for 1991, 1997, and 2006. Ghana has achieved reductions of about 26 points and 23 points in the poverty headcount ratio at US$ 2 a

day and US$ 1.25 a day, respectively. This situation is much better compared with Togo (38.68% in 2006) and Burkina Faso (44.6% in 2009) for the poverty headcount ratio at US$ 1.25 a day.

Table 2-3 Poverty Headcount Ratio in Ghana

(Unit: % of population)

Poverty Headcount Ratio	1991	1997	2006
Poverty headcount ratio at US$2 a day (PPP)	77.65	63.34	51.84
Poverty headcount ratio at US$1.25 a day (PPP)	51.07	39.12	28.59

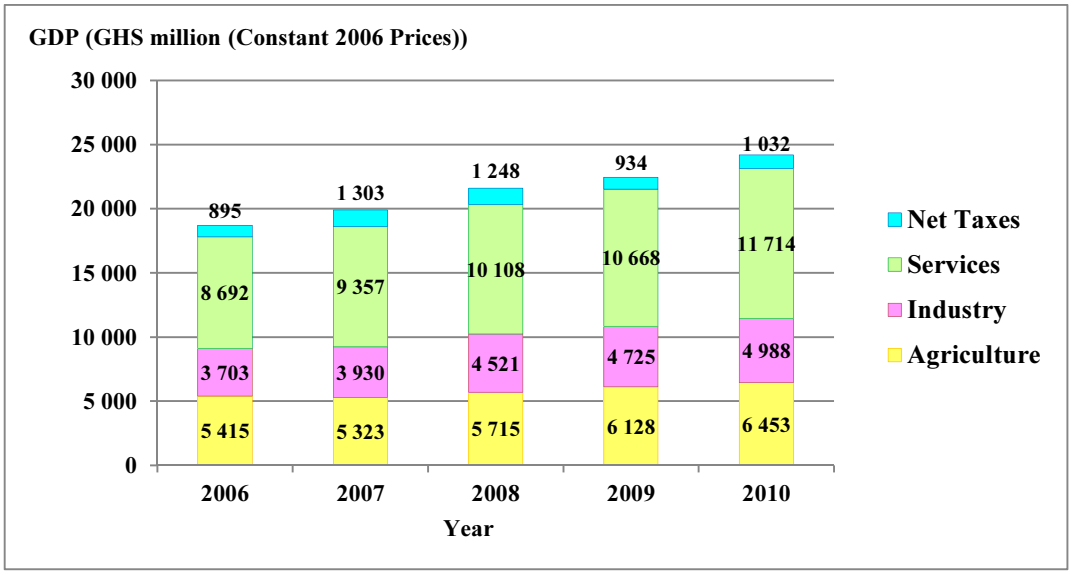
Source: Compiled by the Study Team using WB databank, http://data.worldbank.org/country, April 2012

2.4 Economic Conditions in Ghana and Neighbouring Countries

2.4.1 GDP

(1) GDP by Sector

Table 2-4 and Figure 2-3 show the GDP by sector between 2006 and 2010. The service sector has a share of almost 50%, followed by the agriculture sector (26.7% in 2006) and Industry Sector (20.6% in 2006). The share of the service sector has gradually increased, while the agriculture sector has slightly lost their share, and the GDP price has increased. The GDP growth rate in constant prices of 2006 fell between 2008 and 2009, but recovered again in 2010.



Source: Prepared by the Study Team based on Quarterly Gross Domestic Product, Second quarter 2011, October 2011, GSS

Figure 2-3 Trend of GDP by Sector

(2) GDP of Agriculture Sector

Table 2-5 and Figure 2-4 show the sub-sector GDP within the agriculture sector. The “Crops & Cocoa” sub-sector accounts for almost three quarters of the share, followed by the “Forestry” sub-sector. These two sub-sectors have contributed to an increase in the GDP of the agriculture sector.

Table 2-4 GDP by Sector

(Unit: GHS million, constant price of 2006)

Year	Agriculture		Industry		Services		Net Taxes	GDP Total	Growth Rate
	Price	Share	Price	Share	Price	Share			
2006	5,415	28.9%	3,703	19.8%	8,692	46.5%	895	18,705	-
2007	5,323	26.7%	3,930	19.7%	9,357	47.0%	1,303	19,913	6.5%
2008	5,715	26.5%	4,521	20.9%	10,108	46.8%	1,248	21,592	8.4%
2009	6,128	27.3%	4,725	21.0%	10,668	47.5%	934	22,454	4.0%
2010	6,453	26.7%	4,988	20.6%	11,714	48.4%	1,032	24,187	7.7%

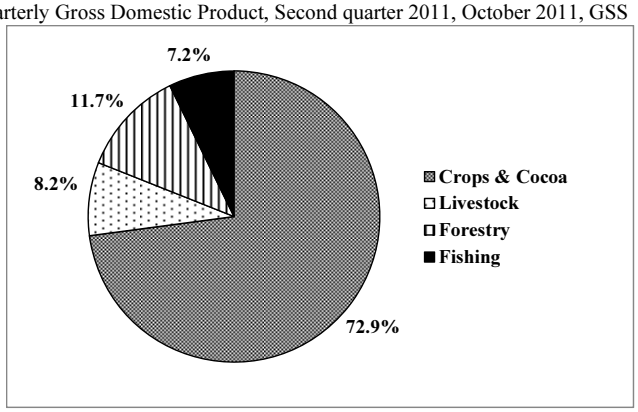
Source: Quarterly Gross Domestic Product, Second quarter 2011, October 2011, GSS

Table 2-5 GDP of Agriculture Sector

(Unit: GHS million, constant price of 2006)

Year	Crops & Cocoa	Livestock	Forestry	Fishing	Total
2006	3,794	437	736	448	5,415
2007	3,743	458	706	416	5,323
2008	4,064	481	682	488	5,715
2009	4,479	502	687	460	6,128
2010	4,703	526	757	467	6,453
(Share)	(72.9%)	(8.2%)	(11.7%)	(7.2%)	(100.0%)

Source: Quarterly Gross Domestic Product, Second quarter 2011, October 2011, GSS



Source: Quarterly Gross Domestic Product, Second quarter 2011, October 2011, GSS

Figure 2-4 Share of Agriculture Sub-sectors within GDP of Agriculture Sector

(3) GDP of Industry Sector

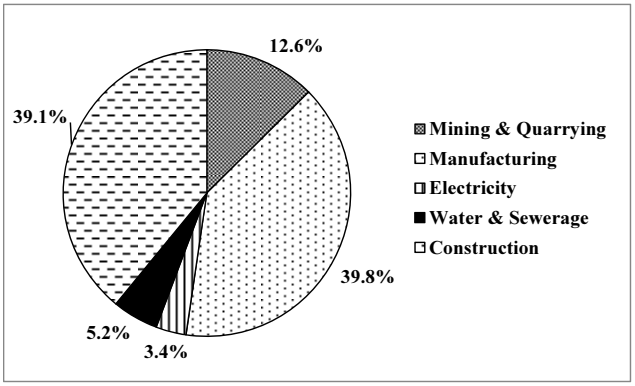
Table 2-6 and Figure 2-5 show the sub-sector GDP within the industry sector. "Manufacturing" and "Construction" are leading sub-sectors in industry with almost the same shares of 39.8% and 39.1%. On the other hand, the leading sub-sector for export, i.e. "Mining and Quarrying", has a share of only 12.6% within the industry sector.

Table 2-6 GDP of Industry Sector

(Unit: GHS million, constant price of 2006)

Year	Mining & Quarrying	Manufacturing	Electricity	Water & Sewerage	Construction	Total
2006	497	1,823	143	224	1,016	3,703
2007	532	1,801	118	227	1,252	3,930
2008	544	1,868	141	229	1,739	4,521
2009	581	1,844	152	246	1,902	4,725
2010	626	1,984	170	259	1,949	4,988
(Share)	(12.6%)	(39.8%)	(3.4%)	(5.2%)	(39.1%)	(100.0%)

Source: Quarterly Gross Domestic Product, Second quarter 2011, October 2011, GSS

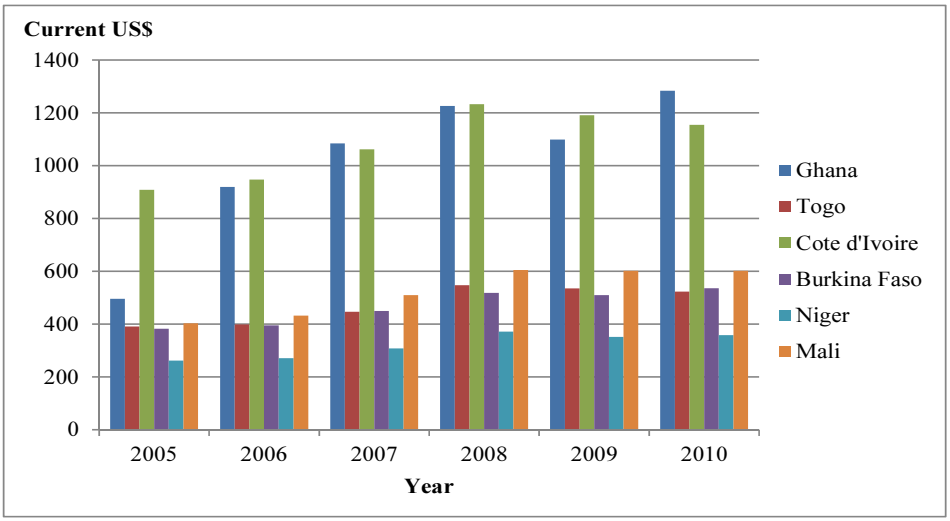


Source: Quarterly Gross Domestic Product, Second quarter 2011, October 2011, GSS

Figure 2-5 Share of Industry Sub-sectors within GDP of Industry Sector

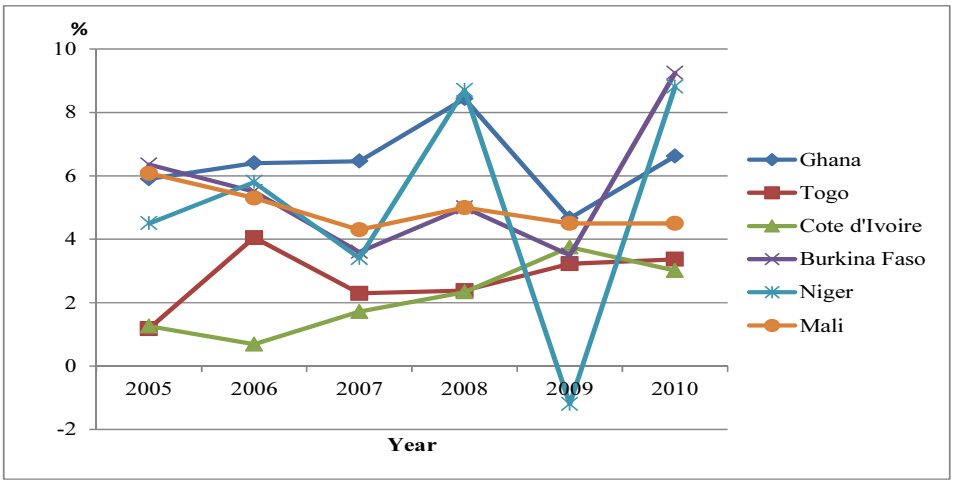
(4) Comparison of GDP per Capita and GDP Growth Rate in Ghana and Neighbouring Countries

Figures 2-6 and 2-7 show the GDP per capita and the fluctuation of GDP growth rate in Ghana and neighbouring countries, respectively.



Source: Compiled by the Study Team using WB databank, http://data.worldbank.org/country, April 2012

Figure 2-6 GDP Per Capita in Ghana and Neighbouring Countries



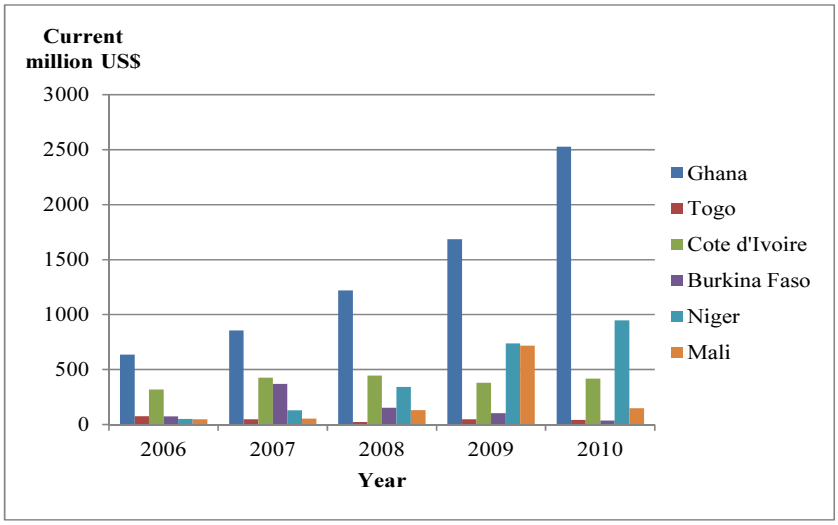
Source: Compiled by the Study Team using WB databank, http://data.worldbank.org/country, April 2012

Figure 2-7 GDP Growth Rate in Ghana and Neighbouring Countries

Among these countries, the GDP per capita has been highest in Ghana (US$ 1,283 in 2010), which is classified as "middle income country" according to the WB definition, however, the GDP growth rate was third, following Burkina Faso and Niger. Since crude oil exploration started in December 2010, real GDP growth is projected by the International Monetary Fund (IMF)[1].to increase by 13.8%, 8.8%, 7.4% and 5.7% in 2011, 2012, 2013 and 2017, respectively.

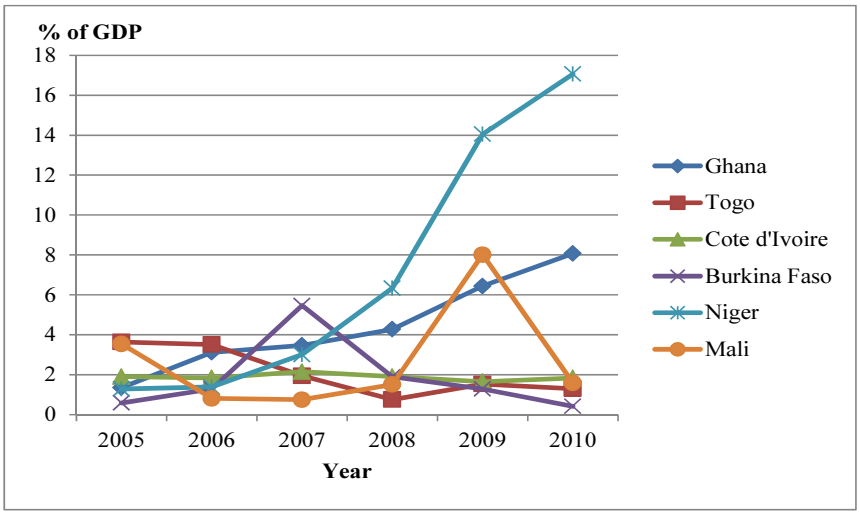
2.4.2 Foreign Direct Investment

Figures 2-8 and 2-9 show the net flow of foreign direct investment (FDI) and its share of GDP in Ghana and neighbouring countries. It is clear that FDI into Ghana is predominant (US$ 2,527 million in 2010) compared with neighbouring countries, mainly because of foreign investments in the mineral and agricultural sectors. Even though FDI is predominant, its share of GDP is 8.1%, which was almost half that of Niger in 2010.



Source: Compiled by the Study Team using WB databank, http://data.worldbank.org/country, April 2012

Figure 2-8 Foreign Direct Investment (Net Flow)



Source: Compiled by the Study Team using WB databank, http://data.worldbank.org/country, April 2012

Figure 2-9 Foreign Direct Investment (% of GDP)

[1] World Economic Outlook April 2012, IMF.

2.4.3 External Trade

(1) Trade Balance

Table 2-7 shows the total imports and exports of Ghana. Even though exports increased up to 2010, the trade balance remains negative.

Table 2-7 Total Imports and Exports

(Unit: US$ million)

Item	2006	2007	2008	2009	2010
Export of Goods and Services	5,125.4	6,056.6	7,070.6	7,609.4	9,481.6
Import of Goods and Services	8,286.5	10,083.0	12,566.6	10,989.4	12,443.6
Trade Balance	-3,161.1	-4,026.4	-5,496.0	-3,380.0	-2,962.0

Source: Ghana's Economic Performance 2009 & 2010, GSS

(2) Export Commodities and Destination Countries

Table 2-8 and Figure 2-10 show the major export commodities of Ghana. Gold and cocoa beans are the major export commodities with a share of 70.6% in 2008. As the second largest producer of gold in Africa and the second largest exporter of cocoa beans in the world[2], those export products greatly contribute to export earnings in Ghana, even though their shares in GDP are limited. Ghana is also a leading exporter of manganese and bauxite, which are exported as ore so their export value is not listed among lading commodities.

Table 2-8 Major Export Commodities

(Unit: US$ million - FOB)

Commodity	2006	2007	2008	Share
Gold	1,130.7	1,458.7	1,713.9	45.0%
Cocoa beans	1,096.3	896.4	974.1	25.6%
Woods	69.0	138.8	123.8	3.3%
Woven fabrics of cotton	228.6	8.2	6.4	0.2%
Tableware & kitchenware	169.4	7.2	8.3	0.2%
Cocoa butter	53.3	85.7	44.9	1.2%
Plywood	57.5	49.3	70.9	1.9%
Sheets for veneering	49.1	73.1	55.4	1.5%
Cocoa paste	88.5	62.0	15.1	0.4%
Other oil seeds and oleaginous fruits	26.5	60.8	52.4	1.4%
Other commodities	645.1	693.6	743.8	19.5%
All Commodities	3,614.0	3,533.8	3,809.0	100.0%

Source: “2010 International Trade Statistics Yearbook”, UN Comtrade, http://comtrade.un.org/pb/

Table 2-9 and Figure 2-11 show the major trading partners of export commodities. In the case of export, the share of South Africa is the highest at 44.0% in 2008, followed by the Netherlands. These two countries are considered to be related to gold and cocoa export.

(3) Import Commodities

Table 2-10 and Figure 2-12 show the major trading import commodities of Ghana. Not like export commodities, there is no predominant import commodity, as the leading commodity petroleum oil and crude, accounts for only 12.7% of total import commodities.

[2] Source: International Cocoa Organization

Table 2-9 Major Export Partners

(Unit: US$ million - FOB)

Country	2008	Share
South Africa	1,676.2	44.0%
Netherlands	447.5	11.7%
India	203.0	5.3%
UK	140.5	3.7%
Malaysia	120.5	3.2%
USA	108.1	2.8%
Switzerland	100.7	2.6%
France	91.2	2.4%
Nigeria	86.0	2.3%
Burkina Faso	81.7	2.1%
Other countries	753.6	19.8%
All countries	3,809.0	100.0%

Source: "2010 International Trade Statistics Yearbook", UN Comtrade, http://comtrade.un.org/pb/

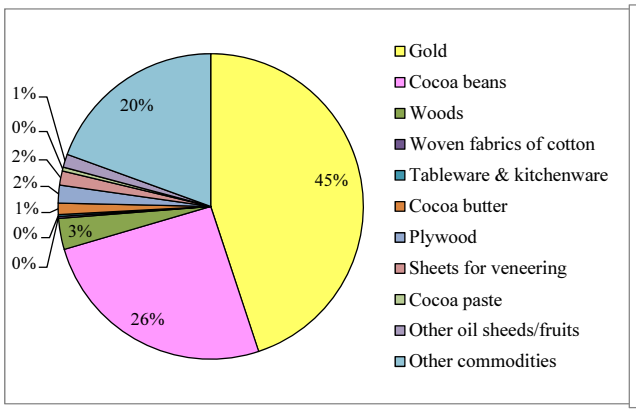
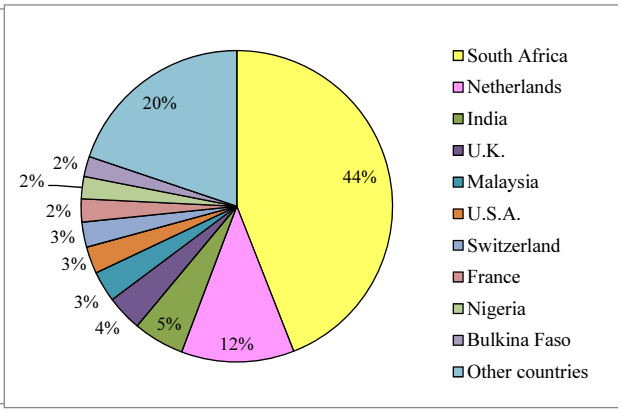


Figure 2-10 Major Export Commodities



Source: "2010 International Trade Statistics Yearbook", UN Comtrade, http://comtrade.un.org/pb/

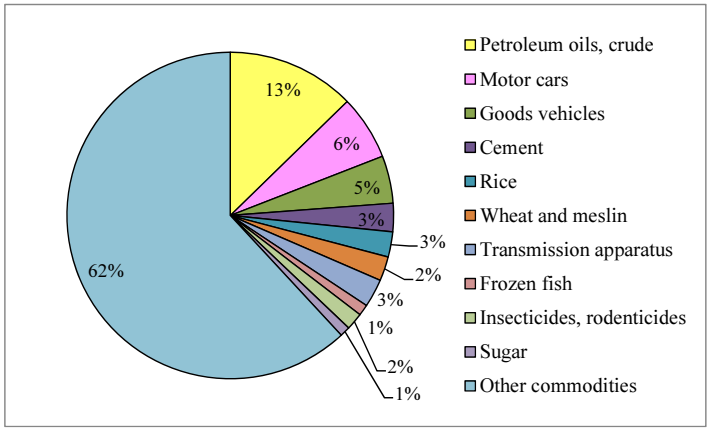
Figure 2-11 Major Trading Partner for Export

Table 2-10 Major Import Commodities

(Unit: US$ million - CIF)

Commodity	2006	2007	2008	Share
Petroleum oils, crude	684.9	790.6	1,084.0	12.7%
Motor cars	420.7	561.9	547.8	6.4%
Motor vehicles for transport goods	250.0	355.6	399.3	4.7%
Cement	163.4	210.5	236.0	2.8%
Rice	118.2	158.4	214.4	2.5%
Wheat and meslin	88.1	111.7	200.7	2.4%
Transmission apparatus for radio-telephony	53.8	100.9	242.5	2.8%
Frozen fish	108.1	138.5	97.1	1.1%
Insecticides, rodenticides	80.7	110.1	143.0	1.7%
Sugar	79.8	115.8	89.6	1.0%
Other commodities	3,281.1	4,624.3	5,281.7	61.9%
All commodities	5,328.8	7,278.3	8,536.1	100.0%

Source: "2010 International Trade Statistics Yearbook", UN Comtrade, http://comtrade.un.org/pb/



Source: "2010 International Trade Statistics Yearbook", UN Comtrade, http://comtrade.un.org/pb/

Figure 2-12 Major Import Commodities

2.4.4 Agriculture

(1) Agriculture in Ghana

Agriculture is the most important economic sector, employing more than half of the population and accounting for almost 27% of GDP and 34% of export earnings.

Agriculture is predominantly on a smallholder basis in Ghana. About 90% of farm holdings are less than 2 ha. in size, although there are some large farms and plantations, particularly for rubber, oil palm and coconut, and to a lesser extent, rice, maize and pineapples. Agricultural production varies with the amount and distribution of rainfall. Soil factors are also important. Most food crop farms are intercropped. Mono-cropping is mostly associated with larger-scale commercial farms.

(2) Production of Major Food Crops

a) Production Trend of Major Food Crops

Table 2-11 shows the production of major food crops between 2000 and 2010. Production of all crops, except cocoyam, has been increasing an average annual 5.1%, reaching almost 28 million metric tonnes (MT) production of rice is increasing the fastest at 8.6%., followed by maize and plantain.

Table 2-11 Production of Major Food Crops

(Unit: 1,000 MT)

Crop	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Ave. Annual Growth Rate
Maize	1,013	938	1,400	1,289	1,158	1,171	1,189	1,220	1,470	1,620	1,872	6.3%
Millet	169	134	159	176	144	185	165	113	194	246	219	2.6%
Rice (paddy)	215	253	280	239	242	237	250	185	302	391	492	8.6%
Rice (milled)	129	152	168	143	145	142	150	111	181	235	295	8.6%
Sorghum	280	280	316	338	287	305	315	155	331	351	324	1.5%
Cassava	8,107	8,966	9,731	10,239	9,739	9,567	9,638	10,218	11,351	12,231	13,504	5.2%
Cocoyam	1,625	1,688	1,860	1,805	1,716	1,686	1,660	1,690	1,688	1,504	1,355	-1.8%
Plantain	1,932	2,074	2,279	2,329	2,381	2,792	2,900	3,234	3,338	3,563	3,538	6.2%
Yam	3,363	3,547	3,900	3,813	3,892	3,923	4,288	4,376	4,895	5,778	5,960	5.9%
Total	16,833	18,032	20,093	20,371	19,704	20,008	20,555	21,302	23,750	25,919	27,559	5.1%

Note: Milled rice is estimated to be 60% of paddy.

Source: Statistics, Research and Info. Directorate (SRID), MoFA, January, 2012

b) Production of Major Food Crops by Region

Table 2-12 shows the production of major food crops by region in 2011 estimated by the Ministry of Foods and Agriculture (MoFA). The three regions which form the Study Area accounted for 39.3% of cassava, 27.7% of maize, 25.3% of both cocoyam and plantain, and 25.1% of rice. This means that these three regions are very important for the production of major crops in the whole country.

Table 2-12 Production of Major Crops by Region in 2011

(Unit: MT)

Region	Maize	Rice	Millet	Sorghum	Cassava	Yam	Cocoyam	Plantain	Ground - nuts	Cowpea	Soya Bean
Western	56,134	21,066	-	-	556,700	49,735	185,269	510,513	-	-	-
Central	202,362	5,366	-	-	1,976,946	15,712	94,347	159,262	-	-	-
Eastern	364,166	22,320	-	-	3,858,149	682,994	253,441	854,240	-	-	-
Greater Accra	4,461	18,773	-	-	71,863	-	-	-	-	-	-
Volta	97,857	75,389	-	5,345	1,660,007	426,751	49,278	62,555	--	1,385	5,001
Ashanti	173,735	27,625	-	-	1,900,444	470,814	385,437	977,432	8,143	2,387	-
Brong Ahafo	434,741	6,160		708	2,883,353	2,171,341	331,873	1,055,832	13,695	7,280	-
Northern	192,604	171,293	79,074	130,634	1,333,406	2,005,607	-	-	224,476	124,720	126,656
Upper West	82,651	6,527	54,327	80,836	-	32,184	-	-	162,265	84,996	17,736
Upper East	75,273	109,455	50,521	69,545	-		-	-	56,524	15,910	15,117
Total	1,683,984	463,975	183,922	287,069	14,240,867	5,855,138	1,299,645	3,619,834	465,103	236,679	164,511
Ratio in Eastern, Greater Accra and Volta	27.7%	25.1%	0.0%	1.9%	39.3%	19.0%	23.3%	25.3%	0.0%	0.6%	3.0%

Source: Statistics, Research and Infomation Directorate (SRID), MoFA,.January, 2012

c) Major Food Crop Production in the Study Area

Table 2-13 shows the major food crop production in each district in the Study Area. The production of major crop varies by district depending on conditions such as terrain, soil and irrigation system. Maize, cassava, yam and plantain are mainly produced in three districts in the Eastern Region, while rice is mainly cultivated in the three districts of Manya Krobo, Dangme West and North Tongu where the irrigation system using water from the Volta River is well developed.

Table 2-13 Production of Major Crops by District in the Study Area - 2011

(Unit: MT)

District	Maize	Rice	Cassava	Yam	Cocoyam	Plantain
Eastern Region						
Asuogyaman	16,083	0	221,500	23,843	190	7,650
Manya Krobo	28,665	3,360	215,400	26,315	868	6,027
Yilo Krobo	18,820	0	170,608	23,200	4,675	5,654
Greater Accra Region						
Dangme West	2,340	18,200	32,400	0	0	0
Dangme East	383	0	18,368	0	0	0
Volta Region						
North Tongu	1,800	2,100	2,500	0	0	0
South Tongu	1,693	135	2,341	0	0	0
Ho	2,919	420	4,311	841	449	286
Adaklu Anyigbe	2,213	266	1,396	104	20	20
South Dayi	2,124	321	1,495	41	122	174

Source: SRID, MoFA.- January, 2012

d) Average Yield of Major Crops

Table 2-14 shows the average yield of major crops by district in the Study Area in 2011. These figures indicate the productivities of crops in each district under the present condition. These average yields can be used to project of future production in the Study Area, where agriculture is expected to be newly developed after the completion of planned road improvements.

Table 2-14 Average Yield for Major Crops by District in the Study Area - 2011

(Unit: MT/ha)

District	Maize	Rice	Cassava	Yam	Cocoyam	Plantain
Eastern Region						
- Asuogyaman	1.8	0.0	20.0	16.5	5.0	8.5
- Manya Krobo	2.1	3.2	20.0	19.0	7.0	9.8
- Yilo Krobo	2.0	0.0	16.0	16.0	5.5	9.6
Greater Accra Region						
- Dangme West	1.3	6.5	14.7	0.0	0.0	0.0
- Dangme East	0.9	0.0	7.0	0.0	0.0	0.0
Volta Region						
- North Tongu	1.5	3.5	11.5	0.0	0.0	0.0
- South Tongu	1.6	2.7	13.1	0.0	0.0	0.0
- Ho	1.5	2.6	14.6	12.9	3.6	10.4
- Adaklu Anyigbe	2.0	2.5	15.3	11.2	4.9	5.3

Source: SRID, MoFA, January, 2012

e) Supply and Consumption of Food Crops

Table 2-15 summarises the food balance sheet of the supply and consumption of food crops in 2010/2011.

Table 2-15 Food Balance Sheet (2010/2011)

(Unit: MT)

Type of Commodity	Total Domestic Production Available for Human Consumption*	Total Imports of Commodities	Total Exports of Commodities	Total Supply of Commodities	Estimated Net Consumption of Commodities	Net Deficit/ Surplus
Cereals	**2,039,539**	**580,800**	**10,150**	**2,696,759**	**2,005,664**	**691,094**
Maize	1,310,187	18,000	10,000	1,400,167	1,060,967	339,199
Rice (Milled)**	256,617	283,000	100	539,517	581,352	-41,835
Millet	190,488	1,800	0	196,878	24,223	172,655
Sorghum	282,247	0	50	282,197	24,223	257,974
Wheat	0	278,000	0	278,000	314,899	-36,899
Starchy Staples	**18,515,382**	**0**	**9,040**	**18,506,342**	**10,214,839**	**8,291,503**
Cassava	9,452,860	0	0	9,452,860	3,703,697	5,749,164
Yam	4,768,389	0	9,000	4,759,389	3,027,875	1,731,514
Plantain	3,007,074	0	40	3,007,034	2,054,110	952,924
Cocoyam	1,287,059	0	0	1,287,059	968,920	318,139
Legumes	**788,212**	**3,730**	**95**	**791,847**	**460,237**	**331,610**
Groundnuts	477,799	150	45	477,904	290,676	187,228
Cowpea	186,369	3,380	0	189,749	121,115	68,634
Soya bean	124,045	200	50	124,195	48,446	75,749

Notes: Estimated population for 2010, based on 2010 provisional census figure = 24.22 million.

* 70% of domestic production for maize and cassava; 87% for rice, millet and sorghum; 80% for yam, 95% for cocoyam; 90% for groundnuts; 85% for plantain and cowpea. Livestock feed, wastage and seed account for the discount.

** Milled rice is 60% of the paddy

Source: Agriculture in Ghana – Facts and Figures (2010), May 2011, MoFA

Although the net deficit/surplus of each type of commodity, i.e., cereals, starchy staples and legumes, is a surplus in total, there is a shortage of milled rice and wheat, even though large quantities are imported. Since rice and bread have become staple foods in addition to the traditional starchy staple foods, the production of rice, which is cultivated in Ghana, needs to be increased in order to minimise the import deficit.

(3) Production of Industrial Crops

Table 2-16 shows trend of production of industrial crops between 2000 and 2010. Cocoa is a traditional export-oriented crop of Ghana, with the sixth-largest global share of 5.4% (US$ 970.2 million by export value in 2010)[3] contributing to 27.2% of export earnings in 2010. In addition, production of oil palm, both by large-scale plantation and smallholder cultivation, has been increasing, however, oil palm products are mainly consumed in Ghana and neighbouring countries.

Table 2-16 Production of Industrial Crops

(Unit: MT)

Year	Cocoa	Coffee	Rubber	Shea Nut	Oil Palm
2000	436,634	1,956	11,080	30,771	1,066,426
2001	389,591	1,379	9,784	19,882	1,586,500
2002	340,562	1,464	10,240	27,160	1,612,700
2003	496,846	338	10,924	n.a.	1,640,100
2004	736,975	477	12,347	n.a.	1,686,800
2005	599,318	270	13,619	n.a.	1,712,600
2006	740,458	164	13,618	n.a.	1,737,900
2007	614,532	304	15,318	n.a.	1,684,500
2008	680,800	2,024	14,132	698	1,896,760
2009	710,638	516	19,134	31,386	2,103,600
2010	903,646	n.a.	n.a.	n.a.	2,004,300
Ave. Annual Growth Rate	7.5%	-13.8%	6.3%	0.2%	6.5%

Source: Agriculture in Ghana – Facts and Figures (2010), May 2011, MoFA

(4) Main Non-traditional Agricultural Products for Export

Table 2-17 shows the values of the main agricultural non-traditional exports between 2005 and 2010. Even though the export value of each commodity varies, exports of banana, vegetables and cashew nuts have continuously increased.

2.4.5 Fishery

Table 2-18 shows annual fish production by source between 2000 and 2010. The production of both marine and inland sources has been decreasing and the majority of fish caught in the sea (mainly tuna) are exported. Instead, cultivation of tilapia using surface water of the Volta Lake and the Volta River has become very popular in Asuogyaman, South Dayi and Dangwe West Districts (these districts are in the Study Area), and 13,561 MT and 1,050 MT of tilapia were cultivated in Asuogyaman District and South Dayi District in 2011, respectively, approximately two to three times the production in 2009.

[3] "2010 International Trade Statistics Yearbook", UN Comtrade, http://comtrade.un.org/pb/

Table 2-17 Values of Main Agricultural Non-Traditional Exports

(Unit: US$ 1,000)

Commodity	2005	2006	2007	2008	2009	2010
Horticultural						
- Pineapple	13,430	19,086	13,475	11,842	10,628	13,555
- Cotton seed	1,762	3,187	3,010	1,624	1,106	172
- Kola nut	125	944	1,296	975	1,463	1,990
- Yam	10,951	14,157	14,551	14,889	12,032	12,688
- Orange (fresh)	3,865	462	333	1,647	875	654
- Vegetables	66	79	49	n.a.	1,362	2,067
- Banana	489	10,330	9,965	12,717	11,590	15,533
- Mango	135	83	998	522	235	230
- Pawpaw	1,081	937	1,020	334	546	971
Processed & Industrial						
- Cashew nuts	5,498	11,975	10,779	20,424	20,154	24,435
- Cocoa products	74,029	152,945	n.a.	n.a.	n.a.	n.a.
- Raw/lint cotton	4,053	4,427	2,102	2,560	n.a.	228
- Robusta coffee	256	133	1,808	n.a.	1,700	1,974
- Shea nuts	28,969	27,249	27,009	24,940	26,853	13,791

Source: Ghana Export Promotion Council (GEPC)

Tilapia cultivation in these two districts is expected to continue increasing, because of the better quality of water and sufficient surface area for cultivation on the Volta River.[4]

Table 2-18 Annual Fish Production by Source

(Unit: MT)

Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Marine	380,000	366,000	290,000	331,412	352,405	322,790	315,530	293,398	343,962	318,300	319,331
Inland	88,000	88,000	88,000	75,450	79,000	82,654	83,168	84,757	72,590	70,898	96,105
Total	468,000	454,000	378,000	406,862	431,405	405,444	398,698	378,155	416,552	389,198	415,436

Source: Directorate of Fisheries, MoFA.

2.4.6 Forestry

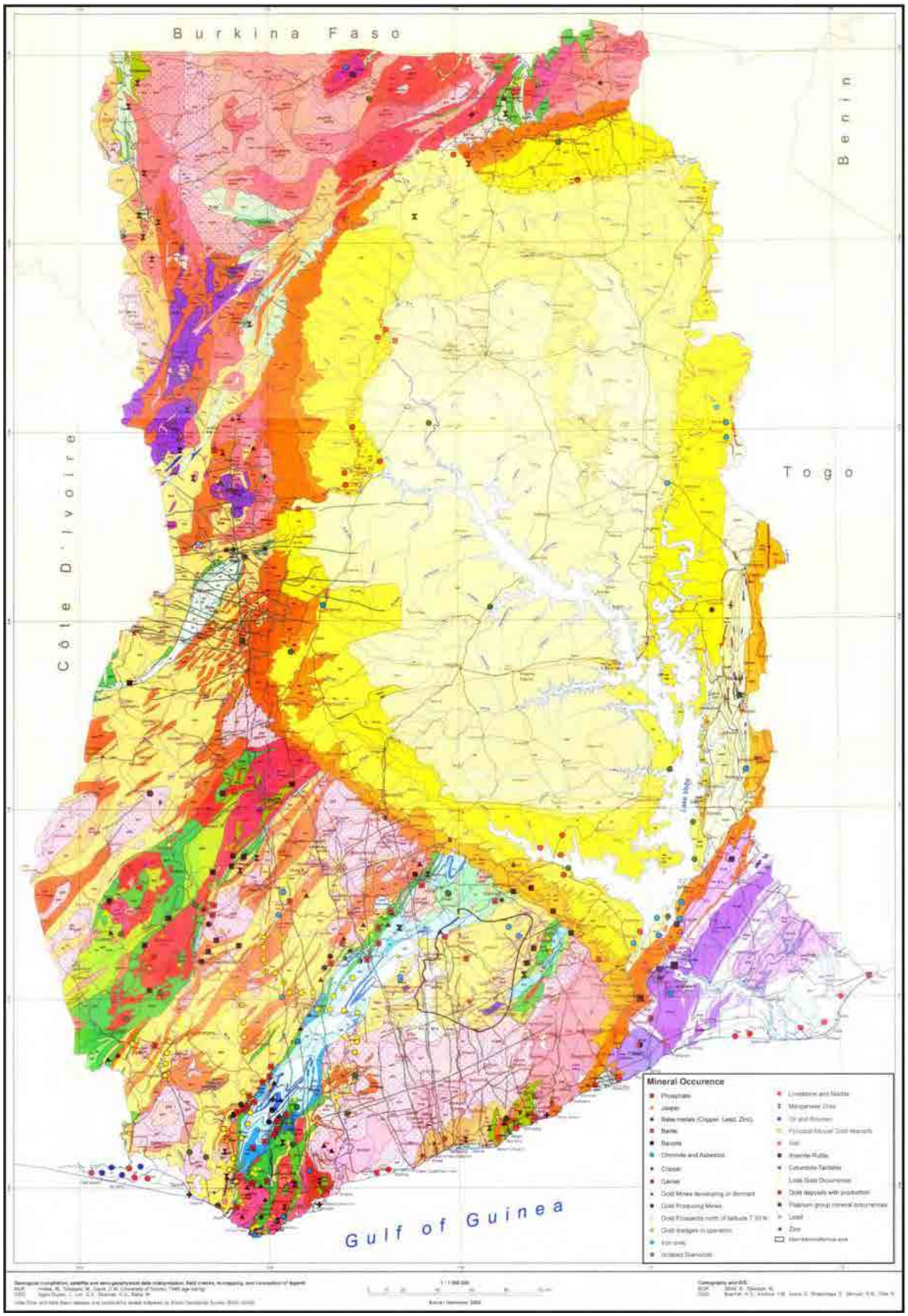
Forests cover about one-third of Ghana's total area, with commercial forestry concentrated in the southern parts of the country. This sector accounted for 3.1% of GDP in 2010, and exports of woods and plywood were the third and fourth largest export earners in 2008, respectively.

2.4.7 Mining

The mining industry is one of the most important sectors for export earnings, with gold alone accounting for 45% of total exports and over 90% of mineral exports, even though the mining sector accounts for only about 2.6% of GDP. Ghana is Africa’s second largest gold producer next to the South Africa, producing 80.5 MT in 2008. Other than gold, Ghana is also a major producer of bauxite, manganese and diamonds, however, bauxite is still exported as ore; without smelting to alumina, even though there is a plan to restart a smelting plant using electricity from the Akosombo hydroelectric power station.

Figure 2-12 shows the minerals occurrence map of Ghana. More than 90% of gold production comes from underground mines in the Western and Ashanti Regions, with the remainder coming from river beds in the Ashanti Region and Central Regions.

[4] Based on an interview with the Fisheries Commission, MoFA



Source: Ghana National Mineral Map Project, 2009, Ghana Geological Survey

Figure 2-13 Geological Map of Ghana with Mineral Occurrence

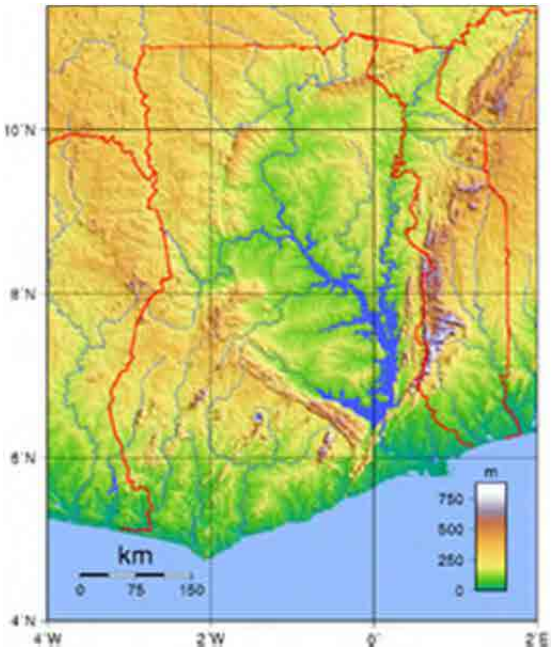
2.5 Natural Conditions in Ghana and the Study Area

2.5.1 Topographical Conditions and Soil

(1) Topographical Conditions

Ghana, which lies in the centre of the West African coast, has a total land borders of 2,093 km: Burkina Faso (548 km) to the North, Côte d'Ivoire (668 km) to the West, and Togo (877 km) to the East. The total area of Ghana is 238,533 km^2. Its Southernmost coast at Cape Three Points is 4° 30' North of the equator. From here, the country extends inland for some 670 km to the North, and is about 560 km across the widest part.

The terrain consists mostly of low plains with the Kwahu Plateau in the South-central area. Half of the country lies less than 152 m above sea level, and the highest point is 883 m. The 537 km coastline is mostly a low, sandy shore backed by plains and scrub and intersected by several rivers and streams. A tropical rain forest belt, broken by heavily forested hills and many streams and rivers, extends northward from the shore, near the Côte d'Ivoire border. North of this belt, the country varies from 91 to 396 m above sea level and is covered by low bush and park-like savannah grassy plains (see Figure 2-14).



Source: http://en/wikipedia.org/wiki/file:ghana_topography

Figure 2-14 Topography of Ghana

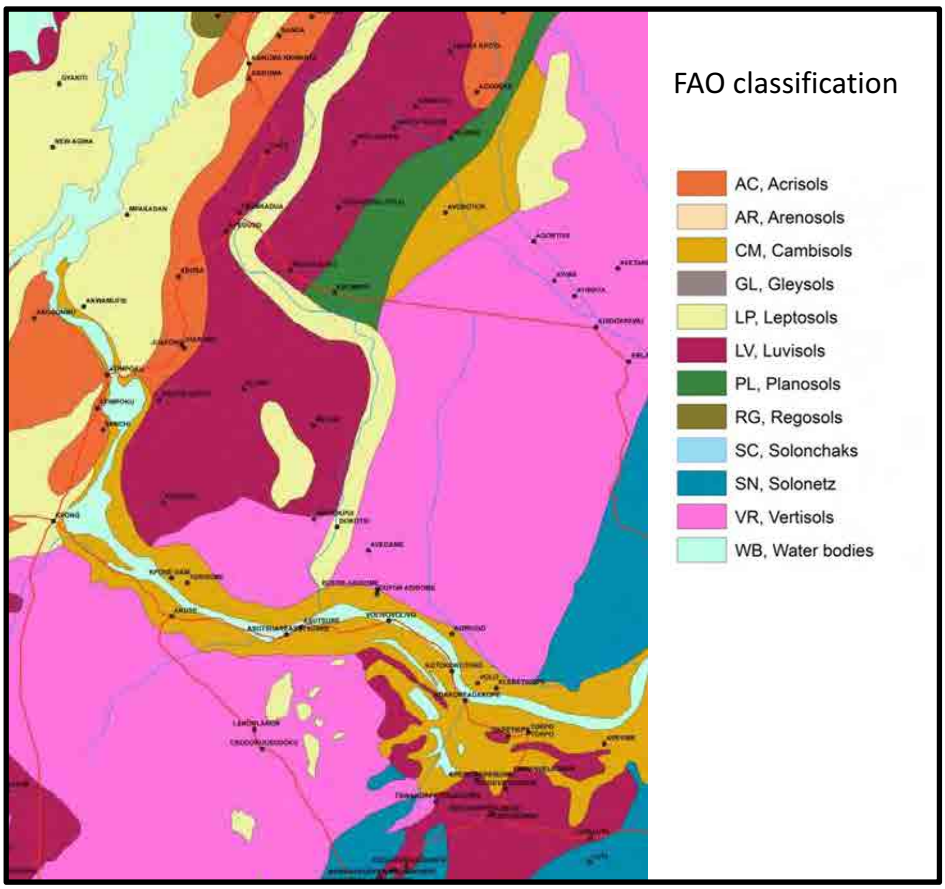
The Study Area lies mainly on the Accra Plains, which are flat and featureless and descend gradually to the Gulf of Guinea along the Volta River. The hills and slopes in this area are suitable lands for cultivation.

(2) Soil Conditions in the Study Area

The United Nations (UN) Food and Agriculture Organization (FAO) developed a supra-national classification, also called the World Soil Classification, which offers useful generalisations about soil pedogenesis in relation to the interactions with the main soil-forming factors[5]. It was first published as the United Nations Educational, Science and Cultural Organization (UNESCO) Soil Map of the World (1974) (scale 1:5 million). Many of the names in the classification are known in many countries and have similar meanings.

The Soil Research Institute under the Ministry of Environment, Science and Technology (MoEST) has prepared a soil condition map covering the whole country of Ghana and Figure 2-15 shows the FAO soil classification in the Study Area.

[5] http://en.wikipedia.org/wiki/FAO_soil_classification



Source: Soil Research Institute

Figure 2-15 FAO Soil Classification Map of the Study Area

According to this FAO Soil Classification, the Cambisol layer is mainly located along the Volta River from the Akosombo Dam, while the Luvisols and Vertisols layers are located behind the Cambisol layer. The Arensols layer and Vertisols layers are highly suitable soil for cultivation, however, the Vertisols layer has the following special feature.

In both the FAO and USA soil taxonomy, a Vertisol is a soil in which there is a high content of expansive clay known as montmorillonite that forms deep cracks in drier seasons or years. Alternate shrinking and swelling causes self-mulching, where the soil material is regularly mixed with itself, causing vertisols to have an extremely deep A horizon and no B horizon. (A soil with no B horizon is called an A/C soil.) This heaving of the underlying material to the surface often creates a microrelief known as gilgai. Vertisols are typically formed from highly basic rocks, such as basalt, in climates that are seasonally humid or subject to erratic droughts and floods, or to impeded drainage. Depending on the parent material and the climate, they can range from grey or red to the more familiar deep black (known as "black earths" in Australia, "black gumbo" in East Texas, and "black cotton" soils in Africa). The natural vegetation of vertisols is grassland, savannah, or grassy woodland. The heavy texture and unstable behaviour of the soil makes it difficult for many tree species to grow, and forest is uncommon. The shrinking and swelling of vertisols can damage buildings and roads, leading to extensive

subsidence. Vertisols are generally used for grazing of cattle or sheep. When irrigation is available, crops such as cotton, wheat, sorghum and rice can be grown. Vertisols are especially suitable for rice because they are almost impermeable when saturated. Rain-fed farming is very difficult because vertisols can be worked only under a very narrow range of moisture conditions: they are very hard when dry and very sticky when wet.

2.5.2 Hydrological Conditions

(1) Hydrological Condition in Ghana

Ghana has a geographical area of 238,533 km^2 and the distribution of river basins is given in Table 2-19 and Figure 2-16. The Volta River Basin is the largest single catchment and drains nearly 70% of Ghana, in addition to Burkina Faso in the North, Côte d'Ivoire in the West and Togo in the East. The entire Volta catchment is low lying and is generally below 183 m above sea level, except for two escarpment uplands rising to 884 m above sea level. In the South east corner of Ghana, the Volta River flows through the Akwapim scarp, a mountain range extending from just north of Accra in a North-eastern direction through Togoland. Most of the Volta River Basin in Ghana is underlain by sedimentary rocks of the Voltain system.

The Volta Basin embraces three major zones of vegetation. The coastal belt extending up to 113 km inland is covered with secondary scrub and a few large trees. Beyond this is the rain forest belt, and the vegetation north of 7°15' latitude consists of rolling savannah and grassland.

Table 2-19 Distribution of Network by River Basin

River Basin	Area (km^2)
Volta Basin	165,712
Black Volta	35,107
White Volta	45,804
Oti	16,213
Volta (below the confluence of the Black Volta, and the White Volta and the Oti)	68,588
River Basins in Southwestern Ghana: Bia, Ankobra, Pra, Ochi, Ayensu, Densu and coastal rivers	64,283
All river basins in Ghana	237,873

Note: River basin areas are converted from sq. mile to sq. km by the Study Team
Source: Ghana Hydrological Networks, H.W. A. K. Sacheyfio, K. Krishnamurthy

(2) Akosombo Hydroelectric Dam

The Akosombo Hydroelectric Dam was constructed in the Akosombo gorge with 25% financial assistance from the WB, United States of America (USA) and United Kingdom in 1965. The primary purpose of the Akosombo Dam was to provide electricity for the alumina smelting industry. Construction of the dam flooded part of the Volta River Basin, and the subsequent creation of Lake Volta. Lake Volta is the world's largest man-made lake, covering 8,502 km^2, which is 3.6% of Ghana's land area.

Its original electrical output was 912 Mega Watts (MW), which was upgraded to 1,020 MW in a retrofit project that was completed in 2006.

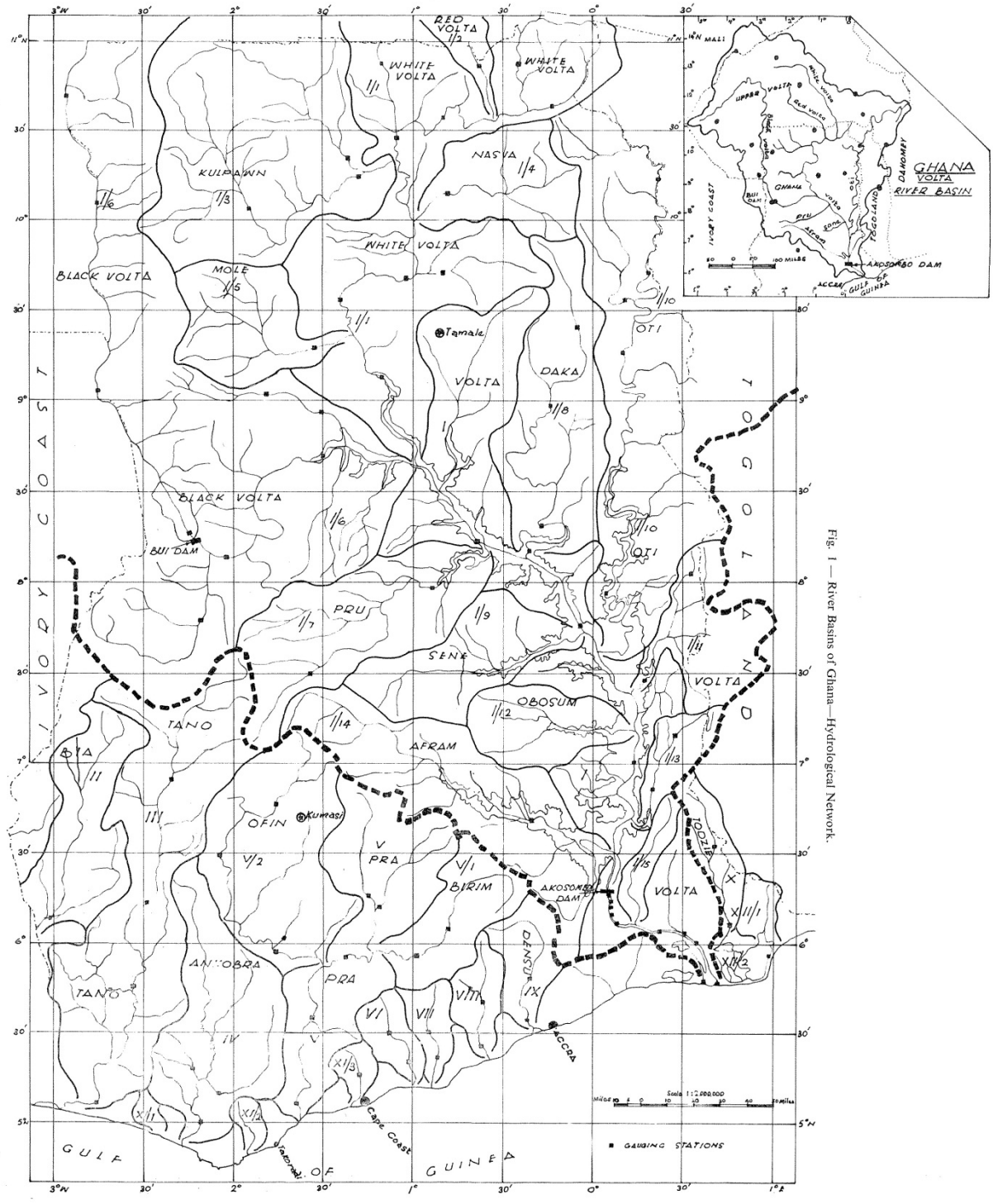


Fig. 1 — River Basins of Ghana—Hydrological Network.

Source: Ghana Hydrological Networks, H.W. A. K. Sacheyfio, K. Krishnamurthy

Figure 2-16 River Basin in Ghana – Hydrological Network

(3) Kpong Hydroelectric Dam

Following the construction of the Akosombo Hydroelectric Dam, the Volta River Authority (VRA) constructed the second largest hydroelectric dam, Kpong Hydroelectric Dam, downstream of the Akosombo Hydroelectric Dam in 1982. Its electrical output is 148-160 MW. The Kpong Dam is also used as the source of irrigation schemes for both sides of the Volta

River.

(4) Hydrological Conditions in the Study Area

The main hydrological source in the Study Area is the lower stream of the Volta River from the Kpong Hydroelectric Dam. The water flow of this lower stream is totally controlled by the Kpong Hydroelectric Dam, with a normal discharge volume of 1,500 m^3/sec. and emergency discharge of 3,000 m^3/sec.

Besides the Volta River, the Alabo River, which originate in the mountain range near Ho and has a catchment area of 185 km^2, flows into the Volta River near Dufor Adidome.

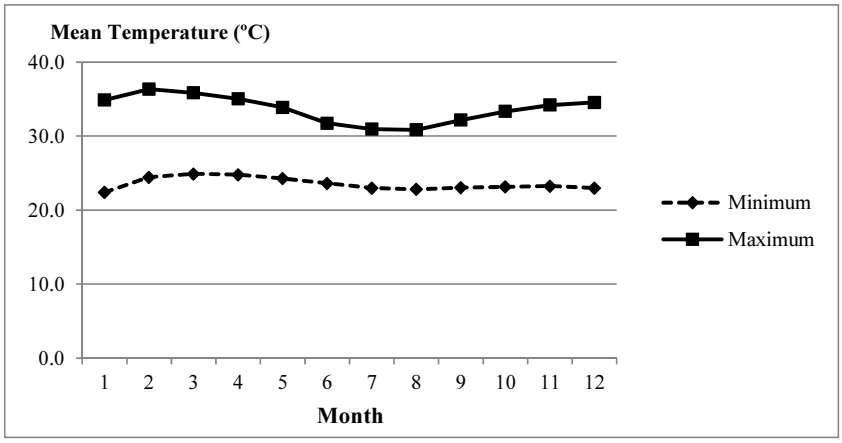
2.5.3 Meteorological Conditions

(1) Climate

Since Ghana is located just a few degrees north of the Equator, the climate is tropical, but temperatures and precipitation vary with season and elevation. There are two rainy seasons, between April and July, and September and October. Since the Study Area along the Volta River is located in flat terrain, while the Northern part of the Study Area, particularly around Ho, is surrounded by mountains, the temperature and precipitation of these two parts are different.

(2) Temperature

Figure 2-17 shows the monthly mean temperature[6] (maximum and minimum) at the Akuse meteorological observatory in Yiro Krobo District of the Eastern Region between 2001 and 2011. The monthly average temperature is lowest in January (22.4ºC) and the maximum temperature is highest in February (36.3ºC).



Source: Ghana Meteorological Agency

Figure 2-17 Maximum and Minimum Temperature at Akuse (2001–2011)

(3) Precipitation

a) Monthly Precipitation

Table 2-20 shows the monthly precipitation at the Akuse and Ho meteorological observatories between 2001 and 2011, while Figure 2-18 shows the variation of monthly

[6] Monthly mean temperature is the mean value of monthly temperature between 2001 and 2011.

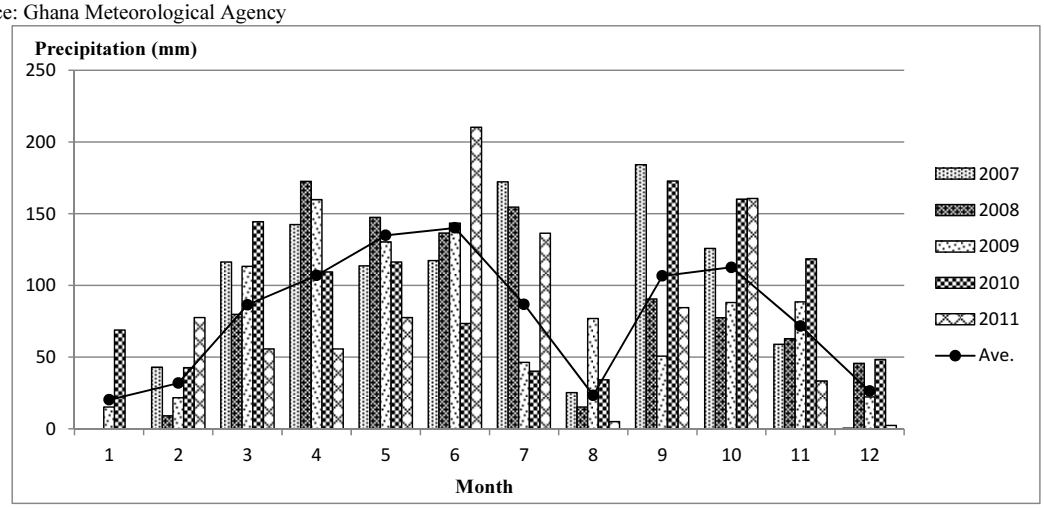
precipitation at Akuse between 2007 and 2011. The average yearly precipitation at Akuse varied between 768.3 mm in 2001 and 1,129.5 mm in 2010, while the average yearly precipitation at Ho varied between 1,076.4 mm in 2001 and 1,878.8 mm in 2008, and about 45% more precipitation was recorded in Ho than Akuse on average. The rainy season starts in April and ends in July, and start again in September and ends in October; rainfall is very limited between December and January.

Table 2-20 Monthly Precipitation at Akuse and Ho between 2001 and 2011

(Unit: mm)

Akuse	Month												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
2001	0.0	2.7	44.8	58.9	144.6	140.9	48.7	1.6	127.3	106.2	89.8	2.8	768.3
2002	78.3	15.4	25.0	176.9	80.5	212.9	68.6	20.7	46.2	121.9	43.3	3.2	892.9
2003	54.9	26.6	62.0	140.3	185.4	150.7	142.6	5.4	58.1	92.2	40.0	14.7	972.9
2004	3.0	70.2	92.2	36.8	161.8	170.8	62.8	40.9	151.2	28.8	98.8	68.8	986.1
2005	0.8	10.5	121.8	53.1	81.1	93.7	76.7	21.8	70.7	173.7	121.2	53.9	879.0
2006	2.4	31.5	96.1	71.2	245.6	91.1	6.6	10.2	136.9	104.0	33.7	27.6	856.9
2007	0.0	42.9	116.3	142.4	113.6	117.4	172.2	25.3	184.1	125.7	59.0	0.5	1,099.4
2008	0.0	9.1	79.8	172.6	147.5	136.6	154.5	15.2	90.6	77.5	62.9	45.6	991.9
2009	15.2	21.8	113.3	159.8	130.3	143.5	46.4	77.0	50.7	88.1	88.6	22.2	956.9
2010	68.9	42.7	144.4	109.5	116.3	73.5	40.2	34.2	172.8	160.1	118.5	48.4	1,129.5
2011	0.0	77.7	55.7	55.8	77.7	210.2	136.4	5.1	84.6	160.6	33.3	2.4	899.5
Ave.	20.3	31.9	86.5	107.0	134.9	140.1	86.9	23.4	106.7	112.6	71.7	26.4	948.5
Ho	**Month**												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
2001	0.0	28.0	168.9	90.7	192.9	166.4	63.8	96.7	182.7	77.4	5.8	3.1	1,076.4
2002	60.6	30.6	125.7	113.1	107.1	175.3	157.7	167.2	163.5	164.9	28.1	6.7	1,300.5
2003	34.7	71.5	28.7	178.3	35.5	324.9	109.9	10.6	190.8	168.1	49.5	86.9	1,289.4
2004	3.9	28.0	88.3	119.8	257.5	116.2	120.0	41.6	454.2	125.8	83.8	29.4	1,468.5
2005	82.4	43.5	173.6	151.2	65.3	117.9	71.9	43.8	150.1	185.6	51.3	53.3	1,189.9
2006	156.8	121.8	221.0	121.4	234.7	289.2	30.2	25.8	89.1	154.5	35.6	5.0	1,485.1
2007	4.4	38.9	122.1	199.7	128.1	262.2	176.1	71.4	256.2	162.0	72.0	0.2	1,493.3
2008	0.0	119.6	146.1	257.8	143.5	239.0	196.5	217.1	277.2	201.1	19.7	61.2	1,878.8
2009	0.0	53.6	99.7	41.9	119.9	224.0	92.0	158.3	82.8	170.6	25.4	38.4	1,106.6
2010	27.9	145.9	85.4	398.4	108.4	186.7	58.8	76.8	227.0	201.5	39.2	6.0	1,562.0
2011	0.0	104.2	60.6	141.3	130.8	140.0	197.2	135.8	175.0	184.1	20.3	0.0	1,289.3
Ave.	33.7	71.4	120.0	164.9	138.5	203.8	115.8	95.0	204.4	163.2	39.2	26.4	1,376.3

Source: Ghana Meteorological Agency



Source: Ghana Meteorological Agency

Figure 2-18 Monthly Precipitation at Akuse between 2007 and 2011

b) Maximum Daily Precipitation

Table 2-21 shows the maximum daily precipitation at the Akuse and Ho meteorological observatories between 2001 and 20011. Daily precipitation exceeded 100.0 mm on 2 days at Akuse and 6 days in Ho in the last 11 years and the highest daily precipitation of 154.2 mm was recorded in June 2006 at Ho.

Table 2-21 Maximum Daily Precipitation at Akuse and Ho between 2001 and 2011

(Unit: mm)

Akuse	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
2001	0.0	1.4	19.8	38.1	34.0	47.4	36.6	1.0	63.6	21.8	37.7	2.4
2002	61.3	6.4	6.1	78.8	31.1	33.9	29.2	5.5	21.4	35.8	20.2	3.2
2003	43.1	17.9	39.9	51.9	128.6	58.4	75.7	5.4	20.5	15.4	17.6	9.4
2004	1.6	53.3	37.7	22.0	33.5	74.4	25.8	22.8	31.2	9.5	35.7	30.4
2005	0.8	6.5	69.4	28.5	27.2	73.7	76.2	21.7	31.2	43.3	53.8	30.5
2006	2.4	19.7	51.8	35.1	101.3	23.4	2.6	6.5	37.9	77.1	22.8	26.8
2007	0.0	28.4	46.8	78.4	60.1	35.9	55.7	12.8	44.9	17.1	28.3	0.5
2008	0.0	9.1	25.4	76.1	33.5	55.3	39.3	6.1	45.8	31.9	36.8	19.1
2009	15.2	5.7	28.9	43.9	83.7	40.7	41.1	59.1	13.3	44.3	27.6	8.4
2010	64.8	17.9	94.9	46.7	28.8	39.3	12.8	21.2	67.0	65.2	52.4	47.6
2011	0.0	34.4	14.0	17.8	30.5	71.7	70.4	2.3	57.7	42.1	22.8	2.4
Ho	**Month**											
	1	2	3	4	5	6	7	8	9	10	11	12
2001	0.0	17.5	40.0	33.4	52.3	70.0	20.8	62.7	64.5	19.4	5.0	1.6
2002	38.6	17.6	31.7	51.0	38.6	58.5	36.9	92.1	57.0	54.9	21.8	5.6
2003	16.4	36.1	23.1	40.7	10.0	115.7	25.6	3.6	64.8	35.2	26.8	45.9
2004	2.2	10.3	26.9	36.6	74.2	32.3	66.6	12.5	107.8	19.3	68.4	16.8
2005	43.4	23.6	49.0	86.8	20.4	41.5	45.0	14.8	58.8	56.0	25.0	24.5
2006	137.0	41.2	120.2	85.6	100.2	154.2	13.5	9.4	24.2	30.6	26.4	5.0
2007	4.4	35.5	62.7	58.0	34.5	56.7	60.5	19.2	78.8	32.4	30.0	0.2
2008	0.0	84.2	52.1	91.2	28.2	83.3	91.9	88.6	94.6	46.0	19.7	33.0
2009	0.0	42.3	36.5	12.3	33.7	89.2	33.5	66.4	27.3	39.2	8.4	16.3
2010	27.3	39.7	33.0	94.4	39.5	73.4	48.3	23.2	74.0	57.6	15.7	6.0
2011	0.0	44.4	18.3	45.6	37.7	44.0	55.2	56.4	30.9	33.3	13.1	0.0

Source: Ghana Meteorological Agency

2.6 Existing Development Programmes

The existing development programmes of Ghana are either comprehensive development plans such as national development plans, or narrow or specific development plans such as regional development plan. Some programmes also focus on particular public industrial sectors.

2.6.1 National Development Plan

In 2000 Ghana adopted the UN Millennium Development Goals (MDG) based on the eight issues listed in Table 2-22 including targets relevant to Ghana's development objectives and the availability of adequate data. Following these goals, the Medium Term National Development Plan (MTDP) has been launched as Ghana Poverty Reduction Strategy (GPRS I) 2003–2005, and anchored to another plan, the GPRS II 2006–2009. The current plan is Ghana Shared Growth Development Agenda (GSGDA) 2010–2013.

Table 2-22 Outline of the Millennium Development Goals

Goal 1	Eradicate extreme poverty and hunger
	Target 1A. Halve the proportion of those in extreme poverty, 1990-2015 Target 1C. Halve the proportion of people who suffer from extreme hunger by 2015
Goal 2	Achieve universal primary education
	Target 2A. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
Goal 3	Promote gender equality and empower women
	Target 3A. Eliminate gender disparity in primary and secondary education preferably by 2005 and in all levels of education no later than 2015
Goal 4	Reduce child mortality
	Target 4A. Reduce by two-thirds between 1990 and 2015 the Under-five Mortality Rate
Goal 5	Improve maternal health
	Target 5A. Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio
Goal 6	Combat HIV/AIDS, malaria and other diseases
	Target 6A. Have halted by 2015 and begun to reverse the spread of HIV/AIDS Target 6C. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases
Goal 7	Ensure environmental sustainability
	Target 7A. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources Target 7C. Halve by 2015 the proportion of people without sustainable access to safe drinking water Target 7D. By 2020 to have achieved a significant improvement in the lives of at least 100 million slum dwellers
Goal 8	Develop a global partnership for development
	Target 8D. Deal comprehensively with LDC debt and make debt sustainable in the long run

Source: NDPC

The Study Team has referred the recent annual report of GSGDA, which was published in August 2011 by the National Development Planning Commission (NDPC) to understand the overall development of Ghana relevant to the Eastern Corridor Development.

(1) Ghana Shared Growth Development Agenda (GSGDA)

Under the previous policy programmes, substantial progress was made towards achieving macro-economic stability and poverty reduction goals. Within the context of the constitutional requirements, the GSGDA is based on the following:

- Ensuring and sustaining macroeconomic stability;
- Enhancing the competitiveness of Ghana's private sector;
- Accelerating agricultural modernisation and natural resource management;
- Oil and gas development;
- Infrastructure, energy and human settlement development;
- Human development, employment and productivity; and
- Transparent and accountable governance.

Since the Study aims to confirm the feasibility of developing part of the Eastern Corridor, specific items which have economic and social impacts, whether positive or negative on the Study Area are chosen from among the above items. The Eastern Corridor Development will result in physical changes by improving the accessibility of the existing corridor, which is an important function of the international corridor. The Study Team examined the relationship

between the impacts generated by improving the corridor and the items related to agriculture and infrastructure development in the GSGDA.

In the GSGDA, the key issue for agricultural development is "Accelerated Agricultural Modernisation and Sustainable Natural Resource Management" which contains two subjects, "Accelerated Agricultural Modernisation" and "Sustainable Natural Resource Management", of which is summarised in Table 2-23.

At the same time, the key issue for infrastructure development is "Infrastructure, Energy and Human Settlement Development" which contains seven subjects. In the Study, five subjects are excluded from the analysis because they are considered unrelated to the Study. Each issue of infrastructure and human settlement development is summarised in Table 2-24.

Table 2-23 Summary of Key Issues in GSGDA – Agricultural Development (1)

Accelerated Agricultural Modernization
1. Improved Agricultural Productivity
• Improve allocation of resources to districts for efficient and cost-effective extension service delivery, especially for women farmers • Build capacity of Farmer-Based Organisations (FBOs) and Community-Based Organisations (CBOs) to facilitate delivery of extension services to their members • Intensify the use of pluralistic extension methods • Establish Junior Farm Field and Life Schools (JFFLS) in the districts to improve livelihood options for young people in deprived communities • Create District Centres for Agricultural Advisory Services (DAAS) to provide advice on productivity enhancing technologies such as drought-resistant seeds and improved breeds for smallholder farmers • Investing in small scale irrigation projects in rural areas
2. Increased Agricultural Competitiveness and Enhanced Integration into Domestic and International Market
• Creating a national buffer stock to ensure food security using the Commodity Exchange • Approaching the establishment of the National Food Buffer Company to stabilize food prices • Developing product clusters to enhance access to technical advice and logistics and promote the utilization of locally processed products through improved quality standards and packaging Partnership between the private sector and District Assemblies will be encouraged to develop trade in internal markets and help minimize risks • Developing commodity brokerage services which will be encouraged to support marketing of agricultural produce and for promoting good agricultural practices along the value chain • Promoting the formation of viable Farmer-Based Organizations to enhance their knowledge and skills • Accessing to resources along the value chain, and foster stronger bargaining power in marketing • The development of agricultural exports is a major strategy to stimulate growth and improve incomes in the sector
3.Reduced Production and Distribution Risk/Bottlenecks in Agriculture and Industry
Irrigation: • To promote the development of appropriate irrigation schemes such as small drainage dams, dugouts and lifting of water from rivers and wells, and other water harvesting techniques for different categories of users • To promote land reforms which ensure equal accessibility to irrigated land especially for women, the youth and persons with disabilities • To promote the use of early warning meteorological information system in agriculture at the district level • To promote the use of existing irrigation facilities and infrastructure along with intervention • To promote the development of small scale community-based valley-bottom irrigation schemes, ground water development and exploitation for irrigation purposes **Accessibility and Sustainable Management of Land:** • Establishment of land banks by District Assemblies and land owners and stools to resolve the problem of land acquisition and security of title • Development of community land-use plans and the enforcement of their use, particularly in urban and pre-urban agriculture • Establishment of agri-business zones and land banks with special consideration for needs of women • Improve access of operators in pre-urban agriculture to sustainable land and environmental management practices. • Establishment of an Agricultural Development Fund • Promotion of agricultural insurance and pension schemes • Promotion of the removal of cultural barriers to land acquisition and ownership by women
4. Selected Crops Development
• Promotion of organic cocoa and oil palm for strategic buyers • Intensification and extension of the mass spraying exercise • Introduction of special incentives to stimulate investments in the processing of cocoa in the country by local and foreign entrepreneurs; establishment of a Task Force to encourage large-scale dawadawa tree development • Processing and utilization; establishment of a Shea nuts Development Board to be responsible for the introduction of effective production, post-production and marketing initiatives • Promotion and the development of the various shea nuts markets locally and globally • Revival of the cotton industry to create jobs and enhance the economy of the three northern regions
5. Livestock and Poultry Development
• Initiate research into large scale breeding and production of guinea fowls, cattle, sheep, and goats especially in the northern regions • Support large scale cultivation of maize and soya-beans for the formulation of animal feed to improve access to quality feed and watering resources • Improve the dispensation of animal health services as well as institute mass vaccination against Pest de Petit Ruminant (PPR) in small ruminants and Newcastle disease in poultry • Improve access of operators to technology and appropriate financial instruments to enhance their competitiveness; design appropriate interventions to address processing and marketing of livestock • Increase awareness on food safety and public health • Strengthen the enforcement of quarantine regulations on livestock movement including those herded by Fulanis

Table 2-23 Summary of Key Issues in GSGDA – Agricultural Development (2)

6. Promotion of Fisheries Development	
	• Preventing the over-exploitation of the resources of the sea and the lagoons caused by inefficient and destructive fishing methods • Promoting the general principles of responsible fishery with emphasis on the enforcement and compliance with the maximum allowable fish catches that will enable the resources to renew themselves • To support the formation of "Fish Farmers Associations" which will be assisted to train their members as service providers • To support sector investments in aquaculture to boost the adoption of scientific practices in the breeding and production of fingerlings, and enhance the general management of different fish species
Sustainable Natural Resource Management	
1. The Vision for the Environmental and Natural Resource Sector	
	• Improved cross-sectorial environmental management, including the consideration of global issues such as climate change and loss of biodiversity, as well as the opportunities of initiatives such as reducing emission from deforestation and forest degradation plus (REDD+), Voluntary Partnership Agreement/ Forest Law Enforcement, Governance and Trade (VPA/FLEGT) • Strategic Environmental Assessment (SEA) applied to inform decision-making and mainstream environment into all sectors of the economy, especially as regards the cost of environmental degradation • Improved Environmental and Social Impact Assessment (ESIA) processes and compliance • Decentralized environmental management, including the enforcement of laws on waste, illegal mining and chain-saw logging at the local level • Improved environmental monitoring and reporting • Strengthened functional partnership and participation in environmental management with civil society including women groups, development partners, industry, and research bodies
2. Investing in the Natural Capital Development	
	Mineral Extraction • Controlling the negative effects of mining (especially illegal mining) by vigorously pursuing the reclamation and plantation development measures in areas mined-out specially by illegal miners • Enhancing international and regional cooperation in the mining industry and actively promote the country's involvement in the Extractive Industries Transparency Initiative (EITI) • Enhancing key Government agencies to improve the performance of the mining sector **Biodiversity** • A Steering Committee will be established to mainstream biodiversity issues into sector programmes to facilitate the development of relevant sector biodiversity policies • The Ministry of Environment, Science and Technology will facilitate the collaboration and harmonization of the biodiversity-related agreements and establish monitoring mechanisms for biodiversity activities **Protected Areas** • Implementing national buffer zone policies for rivers and protected areas incorporating the education of potential users on dangers their activities pose to wildlife and water bodies • Implementing appropriate policies to enable communities near protected areas and local communities benefit from revenues earned from the exploitation of natural resources • Ensuring that local participation is an integral component of forest and wildlife policy by making local communities partners in protected area management where local people will be involved in all stages of the management process • Reversing Land and Natural Resources Degradation through Investments • Promotion of plantation/woodlot development to meet the needs of society • Utilization of non-traditional tree species such as rubber-wood, coconut and bamboo to supplement raw material supply from natural forests • Promoting interactive learning processes that will entail the demonstration of the appropriate use of agrochemicals **Restoration of degraded Forest and Land Management** • Promoting decentralization and participatory wetlands management • Promoting interactive learning processes that will entail the demonstration of the appropriate use of agrochemical • Applying Appropriate agriculture intensification techniques that provide irrigation infrastructure and promote correct soil conservation techniques **Wetlands and Water Resources** • Promoting decentralization and participatory wetlands management • Supporting comprehensive wetlands inventory, backed by research and monitoring and put strategies in place to restore and rehabilitate degraded and badly altered wetlands • Establishing sustainable livelihood strategies so as to enhance poverty reduction in communities that depend on wetlands for their livelihoods **Community Participation** • Enhancing Community participation in environmental and natural resources management • Enhancing community participation in governance and decision-making • Strengthen and develop local level capacity to participate in the management and governance of natural resources

Source: NDPC

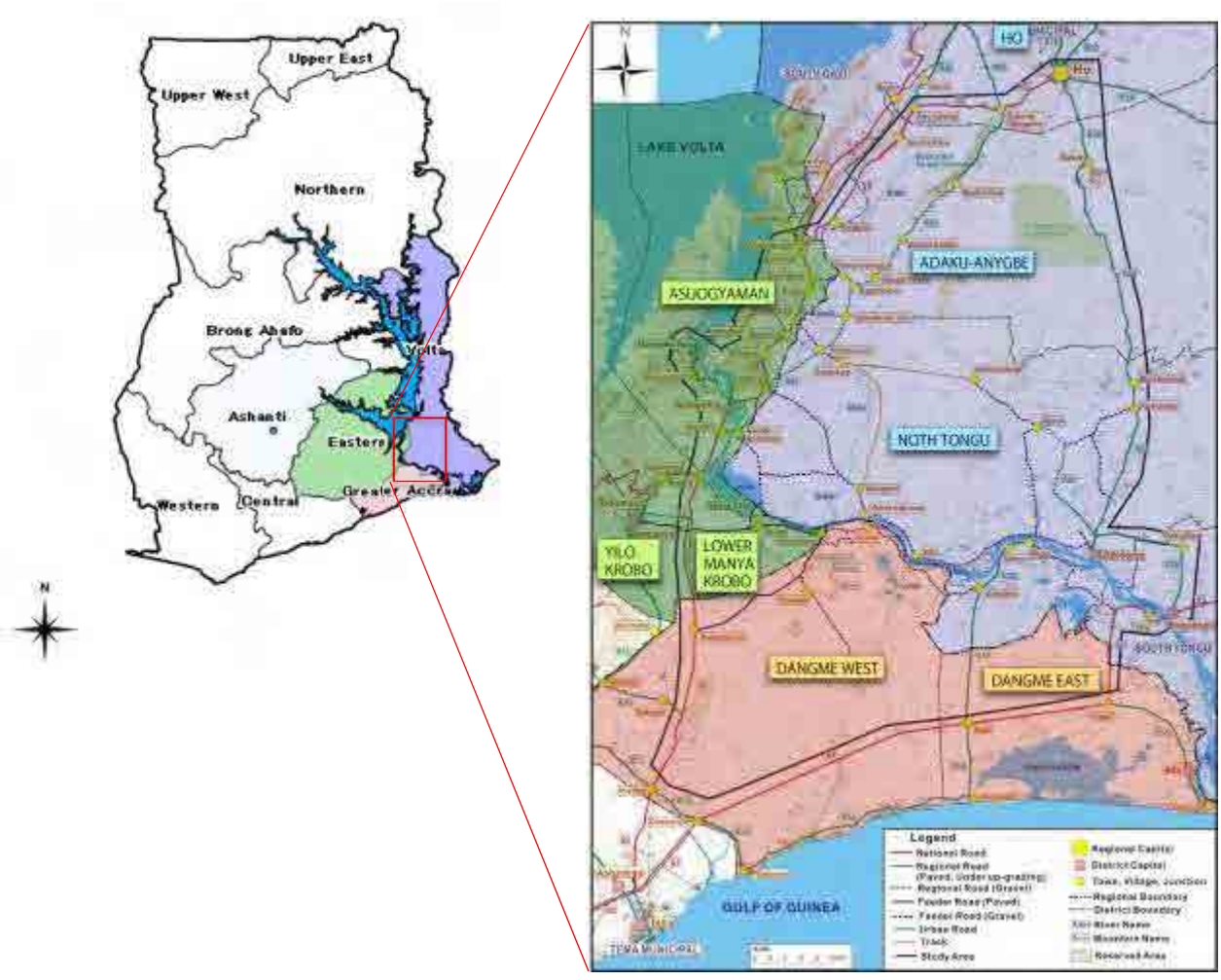
Table 2-24 Summary of Key Issues in GSGDA – Infrastructure and Human Settlement Development

Transportation: Road, Railway, Maritime and Inland Waterway Transport, and Civil Aviation	
1. Roads and Highways	
	• Prioritizing the maintenance of existing road infrastructure to reduce vehicle operating costs (VOC) and future rehabilitation costs • Improving accessibility by determining key centres of population, production and tourism; re-instate labour-based methods of road construction and maintenance to improve rural roads and maximize employment opportunities. • Implementing urban transport projects such as the Ghana Urban Transport Project (GUTP) including the Bus Rapid Transit (BRT) and school bussing schemes. • Exploring Public-Private Partnerships (PPPs) and concession options for investment in transport infrastructure and services (single and multi-modal options) • Building capacity of local road contractors and consultants, and ensure their proper classification and use • Developing the institutional and regulatory arrangements for ensuring the most effective and efficient movement of freight and passengers
2. Lake and Sea Transport	
	• Solving the problems of ageing equipment, and underwater obstructions to safe navigation by dredging, removal of tree stumps from the Lake and the procurement of additional boats, ferries etc. to transform the Volta Lake Transport system into an effective transport system
Recreational Infrastructure	
	• Promoting integrated development planning and strengthen capacity and coordination among Metropolitan, Municipal, and District Assemblies (MMDAs) to enforce planning regulations • Ensuring the creation of green belts to check unrestricted sprawl of urban areas in order to manage and prevent incidence of flooding in urban settlements and also as a climate change adaptation measure • Creating awareness of the need to preserve historic and cultural heritage for the promotion of tourism, among others • Ensuring the involvement of land owners and the local community as stakeholders in the design of urban plans and in the management of protected areas • To strengthen and equip the Department of Parks and Gardens to enable it maintain green areas • Employing the use of artists to raise the aesthetic value of the cities • Promoting attitudinal change, ownership and responsibility among the citizenry and orientate them on the maintenance of recreational areas/facilities • Encouraging the use of Science, Technology and Innovation (STI) for the management, preservation and maintenance of the country's public buildings, including historic buildings and sites • Encouraging education and legislation, the greening of human settlements
Human Settlement Development	
1.Spatial /Land Use Planning and Management	
	• Formulating a Human Settlements (including land development)policy to guide settlements development • Promoting a spatially integrated hierarchy of settlements in support of rapid transformation of the country • Promoting through legislation and education, the greening of human settlements • Ensuring the use of Geographic Information System (GIS) in spatial/land use planning • Integrating climate change adaptation and disaster risk reduction into human settlements and land use planning • Ensuring the drafting and enactment of a coherent and modernized legal framework for land use planning • Strengthening research and development in urban and regional development
2.Urban Development and Management	
	• Guiding relevant MMDAs and the private sector to incorporate urban issues in their policies, strategies and work plans • Ensuring street naming and property addressing system in urban area • Ensuring that urban spatial planning plays a critical role in urban management; provide adaptive space in the urban areas for commercialization • Ensuring proper linkages between urban and rural areas • Instituting a nationwide urban renewal program • Developing the special endowments of towns and cities
3.Rural Development and Management	
	• Improving the supply of a critical mass of social services and infrastructure to meet the basic needs of the people and attract investment for the growth and development of the rural areas • Promoting alternative livelihood programmers to develop skills among rural dwellers • Establishing rural service centres to promote agriculture and agro-based industries • Increasing mining output without compromising the environmental quality of mining communities

Source: NDPC

2.6.2 Regional Development Plan

The information in the MTDP including GSGDA developed by NDPC is followed by the Regional Development Plan (RDP) administered by the Regional Co-ordinating Council (RCC) of ten regional offices respectively. The RDP is a set of combined reports of the MTDP administered by the Municipal Assembly of each district. The MTDP is issued once every three years. The Study Team decided to select the MTDP reported by the districts relevant to the Study Area of the Eastern Corridor Development. Figure 2-19 illustrates the target districts and development subjects in each region selected for the Study in order to identify current or future development in the Study Area. Appendix 1 shows the POCC analysis and the development goals, objectives, policies and strategies in each district.



Source: Study Team

Figure 2-19 Target Districts of Regional Development Plan

(1) Volta Region

a) Ho Municipality

Ho Municipality is the administrative centre and one of the 18 districts in the Volta Region, with an area of 2,660 km^2 and a total population of 236,155 in 2000. About 65% of the people live in rural areas, and the remaining 35% in urban areas. Thus, the population of Ho

Municipality is mostly rural.

Agriculture is the main economic activity in Ho Municipality. About 49% of the population the municipality is engaged in agricultural activities and livestock breeding, most of which is small-scale.

In the MTDP of Ho Municipality, potential opportunity, constrains and challenges (POCC) are defined as follows to analyse appropriate development goals.

- Potentials: Potentials are latent strengths or untapped resources in the district, which are capable of being tapped for the district's development.
- Opportunities: These are positive and development enhancing factors that are external to the district, and on which the district does not have direct control. For example, availability of the District Assemblies' Common Fund (DACF).
- Constraints: Constraints are internal factors (within the district) that inhibit or restrict the district's efforts to unearth and fully utilise its potentials.
- Challenges: These are negative external factors that inhibit the pursuit of development interventions in the district.

The Study examined 6 out of 43 development issues in Ho Municipality, including not only the availability of arable land and water resources for irrigation schemes but also of human resources to organise future agricultural projects, directed by traditional leaders and farmer groups in the district.

The development goals are analysed by respecting the POCC mentioned above. Ho Municipality has set goals within the national context which emphasise human development, transparency and governance, and infrastructure development, to support agricultural modernisation, natural resource development, private sector development, Information and Communication Technology, housing and energy in order to accelerate employment and income generation and thus alleviate poverty .

The Study examined the issues related to development of the Eastern Corridor, including infrastructure, agriculture and natural resource development. In terms of agricultural development, which means agricultural modernisation and natural resource management, some of the significant strategies are developed in the development goals. In addition to introducing high-yielding crops to the farmers, providing irrigation schemes and developing access roads are cited for future infrastructure development, whereas the development of human capacity in agricultural machinery management, operation and maintenance is cited for building human resources.

b) Adaku-Anygbe District

Adaku-Anygbe District was initially formed in the southern part of Ho Municipality in 2005, but the western part was merged into Ho Municipality in 2010, which covers a land area of 1,060 km^2. The district is characterised by mountains and lowland area. The high mountain area known as Adaku Scarp rises to a height of 305 metres above sea level. The population was

66,009 in 2010, with 75% living in rural area and 25% in urban areas.

The road network in the district is generally in poor. There are two paved regional roads, a 41 km stretch of R10 connecting Ho and Kpetoe in Aflao, and R28 connecting Ho and Sugakope. The other roads are feeder roads, which are either gravelled roads or bush tracks accessible only in the dry season.

The major economic activity in the district is agriculture, employing 70% of the labour force, including major food crops, tree crops and livestock. One of the significant industries of the district is kente weaving, which employs about 55% of the labour force.

In the MTDP of Adaku-Anygbe District, POCC has been developed in order to analyse appropriate development goals. The analysis states that the district has a high potential for agricultural modernisation by using existing streams and ponds for irrigations and developing access roads as main infrastructure in the district.

Following the analysis, Adaku-Anygbe District formulated the development goal "To improve socio-economic development by pursuing massive infrastructure development and the development of human capital whilst enhancing good governance." One of the significant strategies of the goals relevant to the Study is the development of appropriate irrigation schemes, dams, boreholes and other water harvesting technologies to manage the modernization of agriculture and natural resources. Apart from the development of agricultural facilities, the development of human capacity in agricultural activities is a high priority of the strategy. In terms of infrastructure, energy and human settlement, the construction of access roads is set as a top priority among the development goals.

c) North Tongu District

North Tongu District is located on both the northern and southern sides of the Volta River in the Volta Region. The area of the district is about 1,460 km^2, accounting for 7.1% of the land area of the Volta Region, and had a population of 167,418 in 2010. The distribution of settlement is 94% in rural areas and 6% in urban areas, indicating that people have to live in rural areas in this district. The district to the north of the Volta River has generally gentle topography, which results in low development costs and favours large-scale mechanised farming, nevertheless there are a large areas of unused land without road access. Part of the district to the south of the Volta River is flat land with an irrigation system and produces large quantities of rice. Three townships, Mepe, Bator and Aveyime are located south of the Volta River.

There are frequent inundation problems on the northern side of the Volta River during the rainy season, caused by backwater of the Volta River and flood water from the Aklakpa River basin, which causes damage to the existing feeder road between Adidome and Juapong.

North Tongu District is surrounded by trunk road N2 to the west and R28 to the east, while R18 connects Aveyime, Bator and Mepe townships from Sege on N1. However, there are only gravel feeder roads running east-west in the district on both sides of the Volta River, while there are only tracks connecting N2 and R28 in the northern part of the district.

Agriculture is the leading sector in the economy of the district. However, it is characterised by low productivity resulting from the continuous usage of indigenous farm implements and practices. In contrast, there are several large-scale commercial farms such as Practice Volta Rice Farm at Aveyime. North Tongu District has one of the largest livestock industries in the country; more than 30 % of farming families in the district keep some livestock.

Regarding other industrial production in the district, there are several distinctive industries such as a textile farm in Juapong, Gari processing at Mafi Kumase, Anfoe, and Mawoepor, brick and textile industry at Adidome, and pottery production at Bakpa and Kpoviadzi.

The POCC in the MTDP of North Tongu District is shown in Appendix 1 and the issues are identified in relation to development of the Eastern Corridor. The analysis states that vast lands for future agricultural development would be available with an appropriate irrigation schemes utilising the existing water body of the Volta River. Since strategies and goals are not given in the MTDP of the North Tongu District, the Study Team notes only the objectives of future development for the district.

(2) Greater Accra Region

a) Dangme West District

Dangme West District is located in the north eastern part of the Greater Accra Region, with the Volta River in the north of the district. The total area of the district is 1,442 km^2, accounting for 41.5% of the land area of the region. The district lies in the heart of the Accra Plains. In addition to the Plain, there are two prominent relief features, the Yongua inselberg (427 m) and the Krabote and Shai Hills (289 m) in the north. The population of the district was 130,260 in 2010. There are extensive irrigation schemes on the low plains from Akuse towards the east along the Volta River; water is drawn from the Kpong Dam reservoir, allowing rice, maize, banana and vegetables to be cultivated on the unfertile soil. The Volta flood plains in the north are suitable for cultivating rice, sugar cane (once a sugar factory was setup, but later closed down due to poor management) and vegetables.

One of the distinctive characteristics of the district relevant to the Study is that part of it is located in the Green Belt. The Southeast Green Belt is a scheme that affects part of the areas of Dangme East, Dangme West, Akwapem North and Akwapem South District Assembly. The scheme covers the hills extending from McCarthy Hill in Accra to the Akwapem range and up to Dawhenya in Dangme West District.

The main purpose of the scheme is to provide land uses and interim planning controls generally in the Green-Belt designated areas. It also seeks to promote sound environmental protection and sustainable human settlement development.

In addition, agricultural farming, the MTDP shows the potential growth of the fishery industry in the lower sections of the Volta River and parts of Lake Volta thanks to the water environment where the Volta River provides cool and oxygenated flowing water throughout the year, which is suitable for tilapia cultivation.

In the MTDP of Dangme West District, the same as the other districts, the POCC has been developed to analyse appropriate development goals. The Study selected particular issues relevant to the Eastern Corridor Development Project to ensure that the district is developed as shown in Appendix 1. The analysis concludes that utilising the potential of large-scale agriculture by irrigation facilities and establishing a mechanisation centre would change the attitudes of farmers, increase product capacity and reduce the high cost of agro-chemicals.

The POCC of Dangme West District states the regional development goal of achieving and sustaining rapid growth and improving on the standard of living of the people in the district.

b) Dangme East District

Dangme East District is located in the eastern part of the Greater Accra Region. The area of the district is about 909 km^2, accounting for almost 28% of the land of the Greater Accra Region. The district had a population of 125,286 in 2010. Regarding the distribution of settlement, Dangme East District is mostly rural with only a few urban settlements. The majority, over 40%, of the labour force are in agricultural sector; they are basically farmers, with the rest being fishermen, livestock breeders and agro-foresters. The district is noted for the cultivation of food crops, especially vegetables, and enjoys a comparative advantage in the production thereof. The crops produced in the district include: cassava, maize, legumes, tomatoes, watermelon, pepper, okra and onions. In the MTDP of Dangme East District, the POCC has been developed to analyse appropriate development goals.

The Study selected issues relevant to the Eastern Corridor Development Project to ensure that the district is developed as shown in Appendix 1. In summary, the district has high potential for the provision of irrigation facilities due to the availability of water from the Volta River, which would lead to large-scale agricultural development in the future.

Based on the POCC, the district formulated the following development goal:

"To achieve sustained economic growth through rapid infrastructure provision which will lead to poverty reduction in an accountable, transparent and participatory environment", thus emphasising the provision of infrastructure as a crucial element for the socio-economic development of the district.

(3) Eastern Region

a) Asuogyaman District

Asuogyaman District is one of 15 districts in the Eastern Region. The district covers an estimated area of 1,507 km^2, accounting for 5.7% of the Eastern Region. The district is rugged in places and characterised by several summits with steep slopes of hard stone and quartzite. The Akwapim-Togo mountain range (700–800 m above sea level) extends into the district and if truncated at Akosombo by the Volta River, forming the Volta Gorge. The gorge area is dammed at Akosombo to generate hydroelectricity for the country. The major water body in the district is Lake Volta, which was formed by completion of the Akosombo Hydroelectric Dam. The 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 Kpong Hydroelectric Dam at the lower stream. The flow of the Volta River through the undulating landscape of the district creates an extensive lakefront good for tourism development.

The population of the district was 93,554 in 2010. Agriculture is the major economic sector in the district, accounting for about 75% of the working population, who are involved in three main types of activities: livestock breeding, food crop cultivation and cash crop cultivation, of which crop farming accounts for more than 78% of all activities. However, fishing on Lake Volta along the 141 km of shoreline of the Kpong headwater is another important economic activity.

One of the significant characteristics of the district is the landscape with Adomi Bridge, which is the only suspension bridge in Ghana, crossing the Volta River at Atimpoku. It is a vital road link over the Volta River, linking by road the central and northern parts of the Volta Region with other parts of the country especially the Eastern, Greater Accra, Ashanti, Central and Western Regions.

The POCC in the MTDP of Asuogyaman District is shown in Appendix 1 and the issues are identified in relation to the development of the Eastern Corridor. The POCC analysis notes that road surfaces have deteriorated due to improper maintenance, and the problems can be managed by ensuring the timely release of funds.

Since the MTDP of Asuogyaman District does not give a development goal, the Study considers only the objectives, strategies and activities of future development for the district. The objectives focus on increasing farmers' ability to handle agricultural technology, encouraging economic activity and boosting livestock.

b) Lower Manya Krobo District

Lower Manya Krobo District is located in the eastern corner of the Eastern Region of Ghana and is the parent district from which Upper Manya Krobo District was carved-out by Legislative Instrument 1842. The district covers an area of 591 km^2.

The topography of the southern part of Lower Manya Krobo District is relatively flat with isolated hills separating the district from the central northwestern point to the east. However, the landscape of the northern part is generally undulating with several streams, most of which drain into Lake Volta. Much of the northern boundary of the district constitutes the shores of Lake Volta.

The economy of the district is dominated by agriculture, with commerce and industry being the least developed. Agriculture accounts for about 80% of the district's labour force, commerce for about 12%, while industry and other sectors account for about 8%.

In the MTDP of Lower Manya Krobo District, the POCC has been developed to analyse appropriate development goals. The Study selected issues relevant to the Eastern Corridor Development Project to ensure that the district is development.

Lower Manya Krobo District formulated the following development goal:

"To improve the quality of life of the citizens through partnership with communities to mobilise resources for wealth creation"

c) Yilo Krobo District

Yilo Krobo District is located in the southern part of the Lake Volta. The District covers an area of about 805 km^2. The population was 190,140 in 2010.

Most of the district is mountainous. The Akwapim Range runs across the district from southwest to northeast. With its accompanying deep valleys, it provides an undulating landscape. The low lands are in the south-eastern part of the district.

There are several reserves in the district, the Boti Falls Forest Reserve and two Forest Reserves at Klo-Begoro. Together, they add up to 21.83 km^2, and various herbs are observed in these forest reserves.

The major economic activities in the district are agriculture, services, trading and small-scale industrial activities. About 58% of the working population is engaged in agriculture, producing mainly staples like maize, cassava, plantain and cocoyam. Service, trading (commerce) and small scale industrial activities employ 18.1%, 12.9% and 7.2% of the working population respectively.

In the MTDP of Yilo Krobo District, the POCC has been developed to analyse appropriate development goals. The Study selected issues relevant to the Eastern Corridor Development Project to ensure that the district is developed as shown in Appendix 1. The POCC analysis states that the district has significant potentials to increase agricultural production and that the problems can be managed through dialogue with banks to solve the constraints of high land rents and labour cost.

Based on the POCC, Yilo Krobo District formulated development goals of the region, which are to attain and sustain rapid growth and improve the standard of living of the people in the district.

2.7 Potential of Growth Sectors in the Study Area

Economic activities in the Study Area cover several major economic sectors in which most of the people in districts are engaged. The major economic sectors of agriculture, mining, and tourism, as well as other sectors such as timber are selected to determine the potential growth because the MTDP of each district shows the importance of the sector to each district's economic activities.

2.7.1 Agricultural Sector

(1) National Level

The Food and Agriculture Sector Development Policy (FASDEP) was developed by the GoG in 2002 to guide development and interventions in the agricultural sector. The first FASDEP plan of 2002, provided a framework for modernising the agricultural sector and making it a catalyst for rural transformation. The Study Team clarified the second plan, FASDEP II, which

was launched in 2007 and seeks to enhance the environment for all categories of farmers, while targeting poor, risk-prone and risk-averse producers. Table 2-25 shows a summary of the FASDEP II, indicating agricultural policy objectives, principles and strategies.

Table 2-25 Agricultural Policy Objectives, Principles and Strategies in FASDEP II (1)

Agricultural Policy Objectives	
▪ Food security and emergency preparedness ▪ Improved growth in incomes ▪ Increased competitiveness and enhanced integration into domestic and international markets ▪ Sustainable management of land and environment ▪ Application of science and technology in food and agriculture development ▪ Improved Institutional Coordination	
Broad Policy Principles	
▪ The GoG shall strive to achieve the Maputo Declaration of allocating at least 10% of annual government expenditure to the agricultural sector ▪ There shall be targeting of the poor in appropriate aspects of policy and programmes ▪ The GoGt shall pursue regional balance in agricultural development, building on regional comparative advantages ▪ All policies and programmes will be designed from a gender perspective, enabling the government to work towards greater gender equality in the agriculture sector ▪ Investments in the sector will be scientifically based and environmentally sustainable and considered on the basis of economic feasibility and social viability/sustainability ▪ Policies and programmes will be implemented within the framework of decentralisation and all agricultural structures of decentralisation will be strengthened ▪ Inter-sector collaboration will be pursued in the implementation of policies and programmes ▪ The GoG shall partner with the private sector and civil society in policy implementation, and reviews ▪ The GoG shall continue to pursue pluralism in service delivery for increased access ▪ The GoG shall foster an enabling environment for the provision of key infrastructure (irrigation, roads, storage, and energy) and information, by the private sector and where necessary shall provide such infrastructure ▪ The GoG shall foster an enabling environment for the enforcement of laws and regulations ▪ All sector policies and plans will be subjected to a Strategic Environmental Assessment (SEA) while all projects will be subjected to an Environmental Impact Assessment (EIA) ▪ DPs will work in ways consistent with the sector policy and the Government in turn will engage DPs in ways consistent with the policy	
Policy Strategies	
➢Food Security and Emergency Preparedness	
Issues	Strategies
▪ Low productivity in staple crop production ▪ · Seasonal variability in food supply and prices due to climatic changes and other natural occurrences make it difficult for Ghana to meet its food demands all year round, especially in the three northern regions ▪ Farmers who are vulnerable to food and nutrition insecurity have limited capacity to respond to agricultural programmes ▪ Poor rural road infrastructure limits the effective distribution of food and lowers producer prices ▪ Weak systems for disaster prevention, preparedness and response (gaps in legal and policy frameworks) ▪ Malnutrition is a serious problem among children, adolescents and women, especially in rural areas and urban slums	▪ Develop appropriate irrigation schemes for different categories of farmers to ensure production throughout the year ▪ Introduce high-yielding and short-duration crop varieties ▪ Develop effective post-harvest management strategies, particularly storage facilities, at individual and community levels ▪ Liaise with the Ministry of Transportation for road transport and the Ministry of Harbours and Railways to improve accessibility and facilitate the distribution of crops ▪ Target the vulnerable in agriculture, with special programmes that will enhance their diversification opportunities, reduce risk and enhance their access to productive resources ▪ Enhance nutrition through the coordination of programmes and institutions for food security, dissemination of nutrition and health information, and advocacy for food fortification ▪ Strengthen early warning systems and put in place emergency preparedness and disaster management scheme, including contingency planning to ensure access of the poor to food during disasters ▪ Establish strategic stocks to support emergency preparedness ▪ Advocate improved legal and policy frameworks for collaboration between institutions responsible for disaster management

Table 2-25 Agricultural Policy Objectives, Principles and Strategies in FASDEP II (2)

➢**Increased Growth in Incomes**	
Issues	Strategies
▪ Earnings in the agricultural sector are generally lower than in other sectors ▪ Limited income growth in indigenous staple crops, livestock and fisheries sub-sectors compared to export crops, as living standards surveys continue to record the highest incidence of poverty among food crop farmers ▪ High income variability due to seasonality in production and prices. ▪ Inadequate attention to value chain development, as evidenced by insufficient grading and standardisation for most agricultural commodities, and low levels of product development ▪ Inadequate expertise in post-harvest and stock management contributes to post-harvest losses and lower incomes ▪ Triple workload of women farmers and producers undermines their productivity and earnings ▪ Limited access of poor farmers (female and male) to key productive resources (land, credit, information, and technology).	▪ Support diversification by farmers into tree crops, vegetables, small ruminants and poultry, based on their comparative and needs; such diversification will also create employment in the dry season ▪ Promote primary grading, processing and storage to increase value addition and stabilise farm prices ▪ Collaborate with MoTI PSD&PSI to develop institutional capacity to support commercial-scale-agro processing and stock management ▪ Develop standards and promote good agricultural practices along the value chain (including hygiene, proper use of pesticides, grading, packaging, standardisation), to enhance quality and incomes ▪ Promote linkage of smallholder production (including indigenous and industrial crops, livestock, and fisheries) to industry ▪ Improve accessibility from farm to market centres ▪ Promote the formation of viable farmer groups and farmer-based organisations with gender equality, to enhance their knowledge, skills, and access to resources along the value chain, and for stronger bargaining power in marketing ▪ Advocate improved rural infrastructure (transport and communication), and appropriate regulatory environment to enhance private sector investments and participation in the delivery of services, including extension. ▪ Advocate the enactment and enforcement of laws on good agricultural practices.
➢**Increased Competitiveness and Enhanced Integration into Domestic and International Markets**	
Issues	Strategies
in development of the domestic market	
▪ Poor condition of roads to production centres, inadequate market information, leading to weak market integration between local, district, and regional markets ▪ Low standardisation and product differentiation in domestic markets (weights and measures; grades and standards) ▪ Uncongenial environment for trading in local markets ▪ Limited marketing extension for producers, traders and exporters	▪ Encourage partnership between the private sector and District Assemblies to develop trade in local and regional markets with improved market infrastructure and sanitary conditions, and enforce standards of good agricultural practices ▪ Encourage the development of commodity brokerage 2-53services to support the marketing of agricultural produce ▪ Create awareness of processors on GAP/HACCP. ▪ Build capacity within MoFA to provide marketing extension
in development of agricultural exports	
▪ The majority of agricultural operators do not have the skills and knowledge of the requirements of external markets, contributing to a high rate of rejection of exports ▪ Inadequate access to market information and lack of capacity to access market intelligence ▪ Limited capacity of exporters to meet export volumes ▪ Inadequate and poor management of logistics in commodity marketing ▪ Weak legal environment does not encourage contract relationships in production and marketing	▪ Provide comprehensive support for improved access of operators to market information and intelligence, technology, relevant market infrastructure, and financing to enable operators to respond to the changing needs of markets. Operators will also be encouraged to identify market niches for new products ▪ Promote good agricultural practices, particularly for meeting sanitary and phytosanitary requirements of importing countries ▪ Advocate a legal environment that supports agricultural production and trade contracts ▪ Collaborate with relevant MDAs to improve road access and link production centres to airport and sea ports

Table 2-25 Agricultural Policy Objectives, Principles and Strategies in FASDEP II (3)

in post-production management	
▪ Inadequate product and cluster development ▪ Low quality and irregular supplies of raw materials to agro-processing enterprises ▪ Inadequate institutional arrangements to support commercial-scale agro-processing ▪ Low patronage of locally processed products	▪ Improve supply chain management with emphasis on developing clusters of small to medium-scale farmers and processors to enhance access to technical advice and logistics ▪ Promote the utilisation of locally processed products and the production of quality and well packaged products to enhance demand ▪ Strengthen linkages between public and private sector institutions to support agro-processing ▪ Provide improved and targeted tax relief for agro-processors ▪ Promote cottage level agro-processing industries with interventions to enhance access to machinery and quality of products ▪ Develop standards on a par with those of competing imports, and advocate their enforcement
➢Sustainable Management of Land and Environment	
▪ Sustainable land and water management are not adequately integrated as part of agricultural extension services ▪ Severe environmental degradation and abuse due to inadequate understanding of environmental issues related to agriculture ▪ Lack of national agricultural land use policy. ▪ Ineffective framework for collaboration with appropriate agencies to address environmental issues related to agriculture	▪ Mainstream sustainable land and environmental management practices in agricultural sector planning and implementation ▪ Create awareness about environmental issues among all stakeholders and develop an effective and efficient framework for collaboration with appropriate agencies to ensure environmental compliance ▪ Adopt an integrated approach in dealing with environmental issues, including an inclusive partnership-based coordinated approach with active and mutual involvement of NGOs and civic organisations, the private sector and Development Partners ▪ Improve incentive and compulsion measures to encourage users of the environment to adopt less exploitative and non-degrading practices in agriculture ▪ Promote joint planning and implementation of programmes with relevant institutions to address environmental issues in food and agriculture ▪ Promote the development of community land use plans and enforce their use, particularly in urban and pre-urban agriculture ▪ Improve access of operators in urban agriculture to sustainable land and environmental management practices ▪ Stimulate, support and facilitate adaptation and widespread adoption of farming and land use practices which, while in harmony with natural resource resilience, also underpin viable and sustainable production levels
➢Sub-sector Policies	
Crop Development Policy	
▪ Limited availability of improved technological packages, especially planting materials and certified seeds by farmers ▪ Low productivity at farm level ▪ Inadequate infrastructure for post-harvest management of food security crops ▪ Inadequate knowledge of sustainable land management practices ▪ Inadequate infrastructure to support the development of horticultural crops for both domestic market and export	▪ Support the production of certified seeds/planting materials and increased farmer usage through intensification of awareness campaigns ▪ Strengthen the dissemination of updated crop production technological packages ▪ Facilitate the development of high-yielding, disease and pest-resistant varieties and increase the supply of certified planting material ▪ Ensure that operators of urban agriculture gain access to the necessary information technology and inputs
Cocoa Strategy	
▪ Land degradation in the cocoa fields ▪ Sustainability of cocoa farming	▪ Promote the commercialisation of research on the utilisation of substandard cocoa and cocoa wastes to enhance added value ▪ Improve the internal and external marketing of cocoa through competition and equal access to COCOBOD's warehousing and crop financing facilities ▪ Rehabilitate roads in cocoa-growing areas to facilitate the transport of the crop ▪ Maintain the responsibility for quality control within public institutions

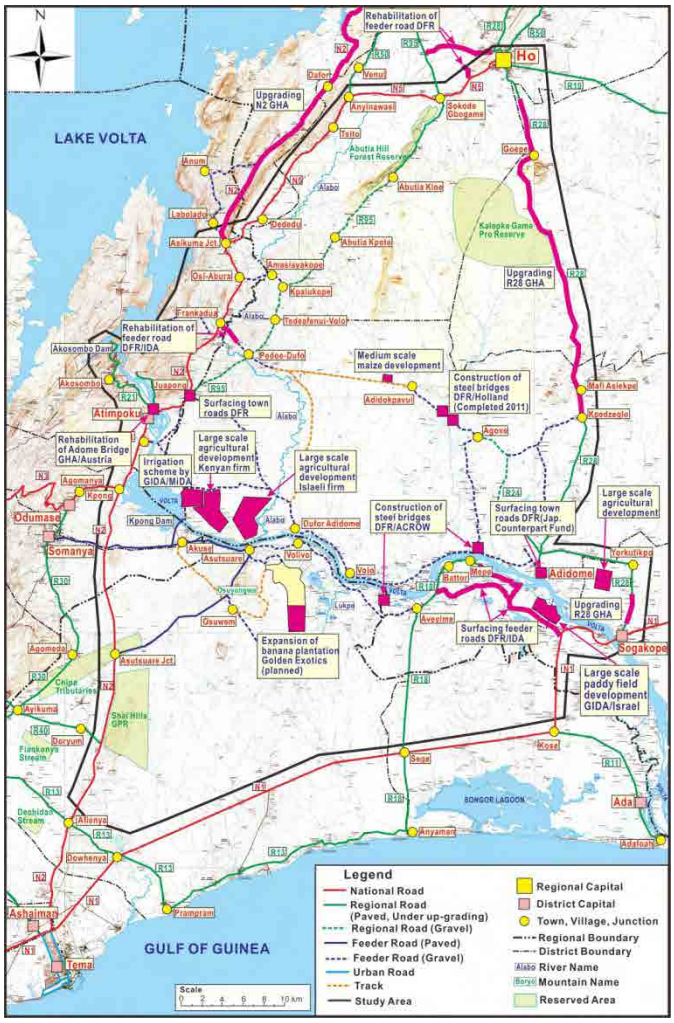
Table 2-25 Agricultural Policy Objectives, Principles and Strategies in FASDEP II (4)

Livestock Development Policy	
▪ Poor genetic material of livestock species ▪ Poor management practices (feeding and health care) and low productivity ▪ Inadequate availability of quality feed ▪ Low application of good agricultural practices in the production, handling and transportation of livestock/livestock products ▪ Low awareness of food safety leading to practices such as use of inappropriate transport in conveying livestock and livestock products. ▪ Poor quality of data and monitoring system	▪ Focus on improving animal health (using community animal health workers) ▪ Improve access to quality feed and water ▪ Enhance the performance of indigenous breeds through a programme of selection ▪ Develop commercial poultry as the priority for improving meat supply in the short term, while implementing measures to transform smallholder production into profitable enterprises ▪ Improve access of operators to technology and appropriate financial instruments to enhance their competitiveness with imports ▪ Advocate fair trade ▪ Design interventions to address the processing and marketing of livestock, and increase the awareness of food safety and public health ▪ Advocate an enabling environment for intensive urban and pre-urban livestock farming ▪ Create awareness among livestock farmers, traders and processors on the Road Traffic Regulations, 2006 (Reg. 122 (6)) on the transportation of livestock ▪ ·Facilitate the development of a livestock statistics and monitoring system
Fisheries Policy	
▪ Increase fish production, increase incomes and employment, protect the fisheries resource and environment and build the capacity of relevant institutions	▪ Improve the management of declining fish resources ▪ Develop under-exploited fisheries resources ▪ Improve product utilisation and marketing ▪ Improve socio-economic infrastructure and opportunities ▪ Promote integrated development of artisanal fisheries ▪ Promote inter-sector cooperation
➢Irrigation Development Strategies	
▪ Low levels of irrigation infrastructure and services ▪ High cost of irrigation development and low capacity of local contractors in the construction of irrigation facilities ▪ Inefficient use of water at formal irrigation facilities ▪ Most irrigation schemes are designed and operated with little consideration for land and water degradation and energy efficiency ▪ Limited knowledge and skills in irrigation farming ▪ Limited stakeholder participation in the design and implementation of public irrigation schemes, leading to conflicts between ownership and rights of irrigators, particularly of women, to land	▪ Promote the design of a programme for harnessing large water bodies, including rainwater harvesting and enhanced capacity for in-soil water retention ▪ Develop cost-effective, demand-driven irrigation infrastructure and support services for both public and private irrigators ▪ Promote the use of small scale pumps along perennial water bodies by small scale farmers ▪ Encourage public private partnership in irrigation development in general, including the management of formal schemes ▪ Facilitate the improvement of user rights to land at irrigation sites ▪ Develop alternative ways of water delivery for irrigation schemes to reduce operational cost associated with energy ▪ Facilitate access of urban farmers to quality irrigation water ▪ Ensure irrigation plans, integrate sustainable management in both the water and land resources, and facilitate the adoption of SLM practices in irrigation farming
➢Plant Protection Strategies	**➢Plant Protection Strategies**
▪ High prevalence of plant pests in the country compounded by introduction of exotic pests. ▪ High rate of interception of Ghanaian non-traditional agricultural exports for non-compliance with phytosanitary requirements of importing countries ▪ Low rate of adoption of improved certified planting materials and plant protection technologies by farmers, especially food crop farmers ▪ Gross misuse, abuse and misapplication of pesticides for crop production ▪ High post-harvest losses of cereals and legumes resulting from storage pests and diseases ▪ Stringent and continually changing SPS requirements of importing countries ▪ Low capacity of regulatory bodies ▪ Outdated plant protection legislation ▪ Weak enforcement of regulations	▪ Promote integrated crop pest management ▪ Strengthen plant pests and disease surveillance, including pest risk analysis, and improve plant quarantine systems at entry points ▪ Strengthen the collaboration among PPRSD, CEPS, and Ghana Immigration Service at all entry points ▪ Strengthen the regulatory and protection services and field surveillance of pesticides sales ▪ Update all laws on plant protection to international standards and enforce them

Source: MoFA

(2) Regional Level

Through activities including site investigation and interviews with the various organisations by the Study Team, agricultural development projects in the Study Area have been identified. The Study concentrated on the main regions in the Study Area, including the southern part of the Volta Region, the eastern part of the Eastern Region and the north-eastern part of the Greater Accra Region. Figure 2-20 illustrates the major agricultural development projects in the Study Area. Most of the large scale agricultural development projects such as plantations of food or cash crops are along the Volta River because of easy access to sufficient irrigation water. Other small and medium-scale agricultural developments, including cattle breeding fields are located along the road regardless of the road condition. Therefore, a major issues for large-scale agricultural development is to ensure a sufficient volume of irrigation water for the crops. In addition to water sources, the functions and quality of access roads to cultivation fields are a key issue for agricultural development of any size of cultivation. The Study Team observed field that had been newly developed by a private firm along a feeder road in the northern part of North Tongu District, where a feeder road, connecting to Adidome, had been up-graded from a track to a gravel road, including the construction of two major bridges completed in 2011. Therefore, improved access by road, of at least gravel standard, will promote investment in agricultural development by securing transport routes between market/distribution centres and cultivation fields.



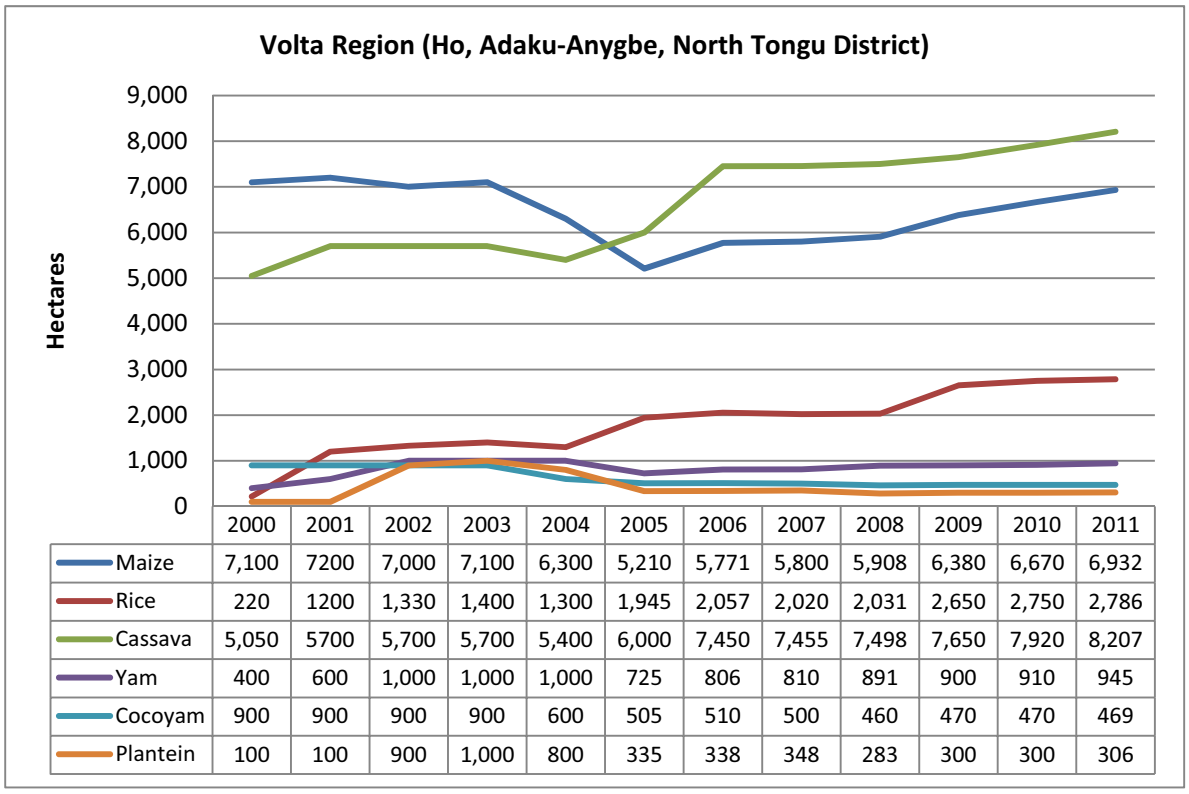
Source: Study Team

Figure 2-20 Agricultural Development Projects in the Study Area

Figures 2-21 to 2-23 show the trend of the major crop products in each region in the Study Area for the last ten years. The gradual increase in the production of every type of crop suggests that construction of proposed road section between Asutsuare Jct. and Asikuma Jct., and improvement of Asutsuare – Aveyime Road will likely lead to rapid agricultural development in the Study Area.

Photo 2-1 New Agricultural Development of Maize

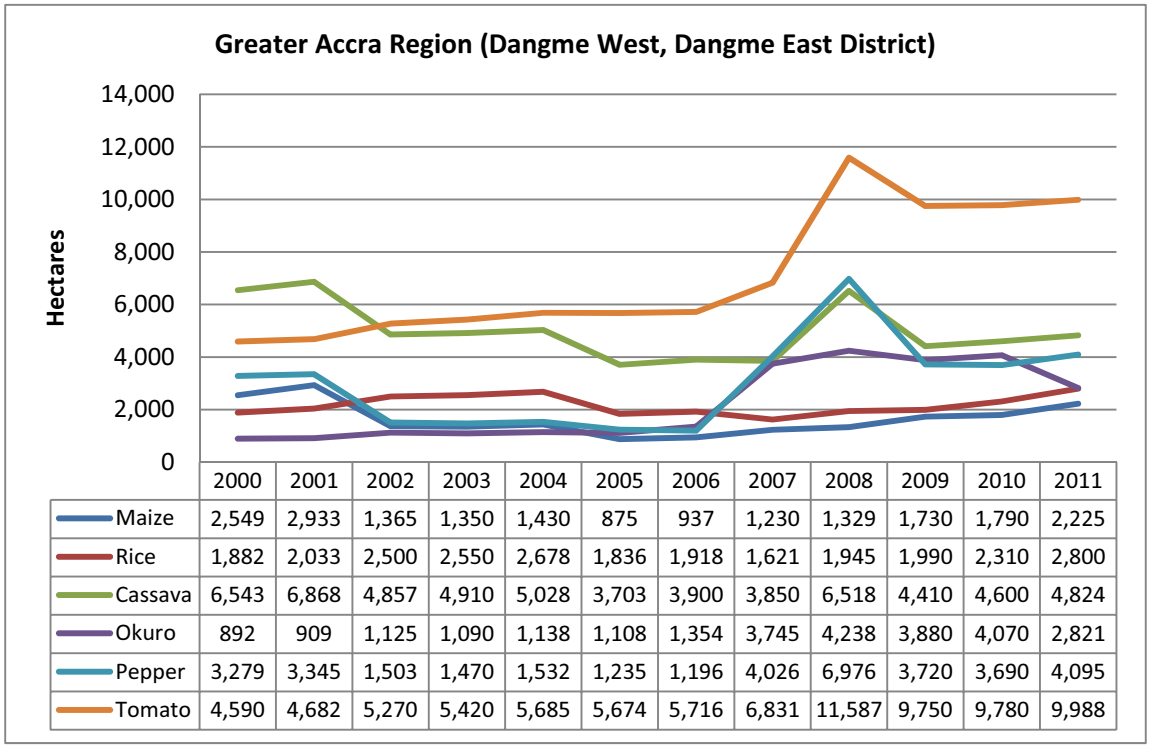
Photo 2-2 Improved Feeder Road with Newly Constructed Bridge



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Maize	7,100	7200	7,000	7,100	6,300	5,210	5,771	5,800	5,908	6,380	6,670	6,932
Rice	220	1200	1,330	1,400	1,300	1,945	2,057	2,020	2,031	2,650	2,750	2,786
Cassava	5,050	5700	5,700	5,700	5,400	6,000	7,450	7,455	7,498	7,650	7,920	8,207
Yam	400	600	1,000	1,000	1,000	725	806	810	891	900	910	945
Cocoyam	900	900	900	900	600	505	510	500	460	470	470	469
Plantein	100	100	900	1,000	800	335	338	348	283	300	300	306

Source: MoFA

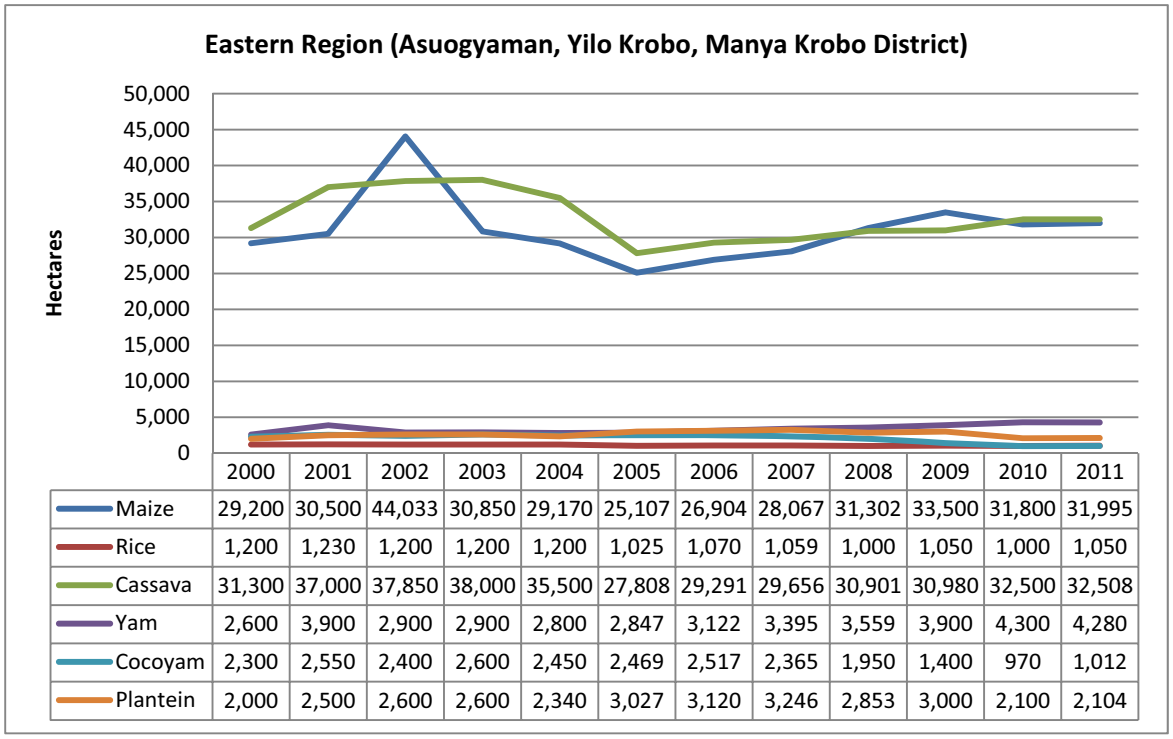
Figure 2-21 Cultivation Area of Major Crops in the Volta Region (Ho, Adaku-Anygbe, North Tong Districts)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Maize	2,549	2,933	1,365	1,350	1,430	875	937	1,230	1,329	1,730	1,790	2,225
Rice	1,882	2,033	2,500	2,550	2,678	1,836	1,918	1,621	1,945	1,990	2,310	2,800
Cassava	6,543	6,868	4,857	4,910	5,028	3,703	3,900	3,850	6,518	4,410	4,600	4,824
Okuro	892	909	1,125	1,090	1,138	1,108	1,354	3,745	4,238	3,880	4,070	2,821
Pepper	3,279	3,345	1,503	1,470	1,532	1,235	1,196	4,026	6,976	3,720	3,690	4,095
Tomato	4,590	4,682	5,270	5,420	5,685	5,674	5,716	6,831	11,587	9,750	9,780	9,988

Source: MoFA

Figure 2-22 Cultivation Area of Major Crops in the Greater Accra Region (Dangme West and Dangme East Districts)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Maize	29,200	30,500	44,033	30,850	29,170	25,107	26,904	28,067	31,302	33,500	31,800	31,995
Rice	1,200	1,230	1,200	1,200	1,200	1,025	1,070	1,059	1,000	1,050	1,000	1,050
Cassava	31,300	37,000	37,850	38,000	35,500	27,808	29,291	29,656	30,901	30,980	32,500	32,508
Yam	2,600	3,900	2,900	2,900	2,800	2,847	3,122	3,395	3,559	3,900	4,300	4,280
Cocoyam	2,300	2,550	2,400	2,600	2,450	2,469	2,517	2,365	1,950	1,400	970	1,012
Plantein	2,000	2,500	2,600	2,600	2,340	3,027	3,120	3,246	2,853	3,000	2,100	2,104

Source: MoFA

Figure 2-23 Cultivation Area of Major Crops in the Eastern Region (Asuogyaman, Tilo Krobo and Manya Krobo Districts)

(3) District Level

In order to analyse the state of agricultural development the Study Area as the district level, the Study Team separated the Study Area into three areas by political boundary: the districts along the Volta River, the districts along the Alabo River and the northern part of the Study Area.

a) Districts along the Volta River (Lower Manya Krobo, North Tongu, Dangme West and Dangme East)

Districts along the Volta River are undergoing various agricultural development, which is classified as large-scale development. As a part of the Southeast Green Belt scheme, the irrigation system along the Volta River has been developed since the 1980's to meet the agricultural development policy of each district. The irrigation scheme is still being developed and expanded.

The major crops cultivated in large-scale agricultural fields are rice, banana on the right bank of the Volta River, and maize, baby corn, and chili will be cultivated on the left bank of the Volta River.

In addition to crop cultivation, small and medium-scale tilapia cultivation farms have been setup along the Volta River and tilapia are cultivated using live-boxes fixed in the Volta River. Since one of the strategies in the MTDP of the districts mentioned above is to promote fisheries, the Study should consider the further potential of tilapia cultivation.

Photos 2-3 to 2-8 show the present situation of agricultural activities along the Volta River.

b) District along the Alabo River (District: North Tongu and Adaku-Anygbe)

Agriculture in districts along the Alabo River is classified as small-scale and medium-scale development located along the existing feeder roads. In the district profiles, the land along the Alabo River becomes relatively dry during the dry season. However during the rainy season, the rain water erodes the crop fields and damages the feeder roads. Therefore, it is not appropriate or advisable to use water from the Alabo River as a source of irrigation water for crops, which is one of the reasons why only small- or medium-scale agricultural fields have been developed in this area so far. However, the soil in this area (Vertisols or so-called black cotton soil) is suitable for mechanised cultivation of crops, and so this area has high development potential.

Photos 2-9 to 2-10 show the present situation of agricultural activities along the Alabo River. There is about 25,000 ha of arable land on this Vertisols soil, which is currently not fully used for cultivation due to lack of an access road to transport agricultural products. As most of the new agricultural development on the northern side of the Volta River is carried out on land of Vertisols soil, there is great potential for the development of this 25,000 ha of arable land, if a direct access road to a big market is constructed.

Based on the average yield and the nominal weighted average rural wholesale price in the Volta Region, the harvest revenue from this arable land is estimated as shown in Table 2-26.

Photo 2-3 Left Bank Agricultural Development Construction of Irrigation System

Photo 2-4 Left Bank Agricultural Development Rice and Vegetable Field

Photo 2-5 Right Bank Agricultural Development Paddy Field

Photo 2-6 Right Bank Agricultural Development Banana Plantation

Photo 2-7 Right Bank Agricultural Development Existing Irrigation Channel

Photo 2-8 Right Bank Agricultural Development Tilapia Cultivation in the Volta River

Photo 2-9 Agricultural Development along Juapong – Adidome Road

Photo 2-10 Cultivation of Vertisols Layer

Photos by the Study Team, April 2012

Table 2-26 Estimation of Harvest Revenue from 25,000 ha of Arable Land

Major Crop	Average Yield[1] (MT/ha)	Production Amount (MT)	Unit Price per MT[2] (GHS)	Harvest Revenue per Year (GHS)	Harvest Revenue per Year[3] (US$)
Maize	1.81	45,369	487.40	22,112,856	11,762,158
Sorghum	1.21	30,345	659.30	20,006,521	10,641,767
Cassava	15.78	394,605	223.57	88,221,739	46,926,457
Cocoyam	7.86	196,541	509.15	100,068,955	53,228,168
Plantain	7.92	197,974	554.11	109,699,507	58,350,802

Source: 1 Major Crops of Average Yield in Volta Region from Production Estimates 2011, MoFA.
2 Nominal Weighted Avarage Rural Wholesale Price (GHS) Per MT in 2010 from Agriculture in Ghana Facts and Figure 2010 issued by MoFA.
Note: US$1=GHS1.88 (exchange rate used in the Study)

c) Districts in the North of the Study Area

(Northern Part of North Tongu and Southern Part of Ho Municipality)

The area in the northern part of the Study Area has a similar environment for agricultural development as the area along the Alabo River. Only the areas along the existing regional road R95 and feeder roads are utilised by the local farmers, and so arable land will become available for cultivating food crops and fruits if road access to this area is improved.

Photos 2-11 to 2-14 show the present situation of agricultural activities in the northern part of the Study Area.

Photo 2-11 Agricultural Development Oil Palm Field

Photo 2-12 Agricultural Development Overview of Scattered Small Agricultural Fields

Photo 2-13 Agricultural Development Overview Small-scale Crop Fields along R95

Photo 2-14 Agricultural Development Rain-fed Medium-scale Cultivation

Photos by the Study Team, April 2012

2.7.2 Mining Sector

(1) National Mining Policy

Ghana is well endowed with substantial mineral resources. The major mineral resources are gold, diamonds, manganese and bauxite, while other mining resources include unexploited deposits of iron ore, limestone, brown clay, kaolin, mica, columbite-tantalite, feldspar, silica sand, quartz, salt, etc. However, the mining sector has dramatically declined since the 1980s because of worn-out and run-down infrastructure, obsolete plant and equipment, mismatch between production cost and revenue due to overvaluation of the local currency, and an exodus of skilled personnel.

The National Mining Policy was prepared to meet the provisions of the Constitution of the Republic of Ghana, 1992 (amended in 1996) and with a view to complementing the GPRS II, the MTDP and the Better Ghana Agenda, which set out measures and initiatives for economic growth and improvement in the standard and quality of life of all Ghanaians. The policy was launched to secure the continued development of a thriving mining industry that will contribute to sustainable economic development based on the following objectives:

- Diversify the country's export base and thereby increase foreign exchange earnings;
- Optimise tax revenue generation to support development;
- Generate skilled employment and develop local capacity for the mineral industry;
- Create demand for local goods and services;
- Contribute to infrastructure development;
- Produce raw materials for local usage;
- Contribute to the transformation of mining, especially rural, communities;
- Serve as a catalyst for wider investment in the economy; and
- Collaborate in the harmonisation of mineral policy in ECOWAS and, indeed, in Africa.

To clarify the direction of the mining sector in Ghana, the Policy include the following guiding principles as follows:

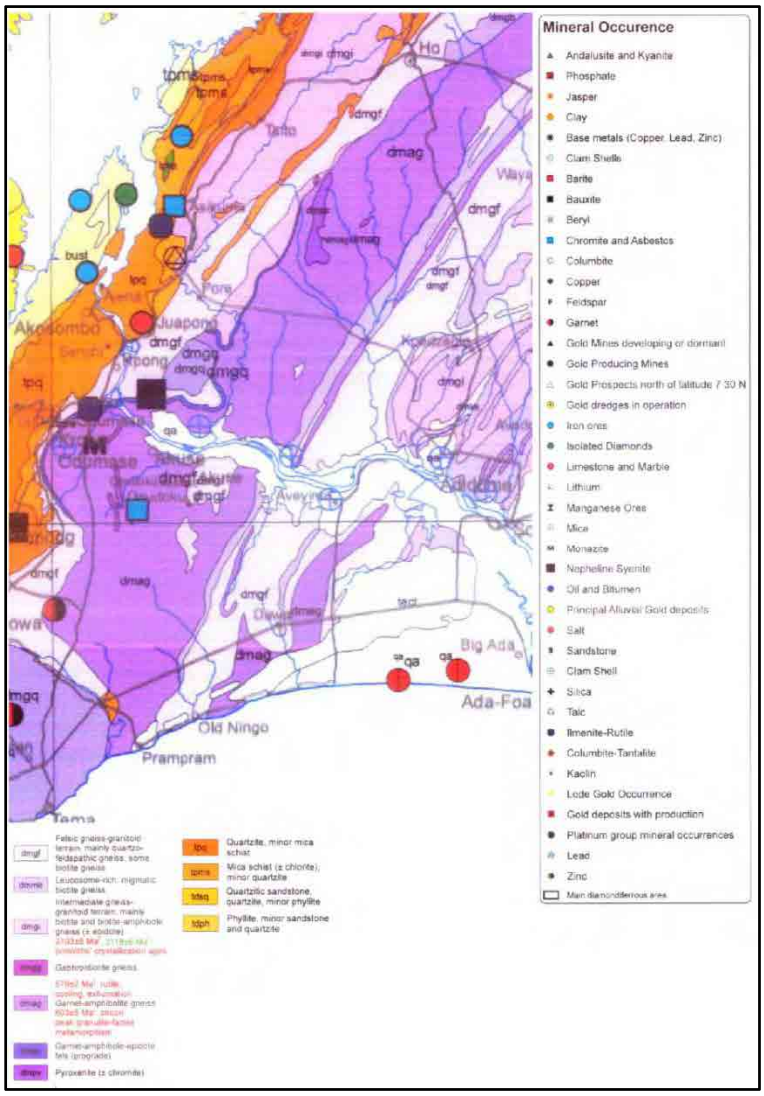
- Ensuring that Ghana's mineral endowment is managed on a sustainable economic, social and environmental basis, with due regard to internationally accepted standards of health, mine safety and environmental protection
- Fostering the development of a mining sector that is integrated with other sectors of the national economy, which will contribute to the economic empowerment of Ghanaians by generating opportunities for local entrepreneurship, increase demand for local goods and services and create employment for Ghanaians
- Application of modern principles of transparency and accountability to the administration of mining laws and regulations
- Ensuring an equitable sharing of the financial and developmental benefits of mining between investors and all Ghanaian stakeholders
- Respect for the rights of communities that host mining operations

- Encouraging local and foreign private sector participation in the exploration for, and commercial exploitation of, mineral resources
- Recognising the need to establish and maintain: 1) a conducive macro-economic environment for mining investment; and 2) a predictable regulatory environment that provides for the transparent and fair treatment of investors
- Ensuring availability and dissemination of geo-data necessary for the promotion of minerals sector investment
- Incorporating in the licensing system an early focus on mine closure planning to anticipate and provide ahead for environmental, social and economic consequences
- Promoting additional and alternative livelihoods in mining communities
- Supporting the development of Ghanaian mining skills, entrepreneurship and capital by encouraging and facilitating the orderly and sustainable development of small-scale mining in precious and industrial minerals
- Empowering Ghanaians to become professional miners, mine managers and owners by maximising opportunities for minerals-related education, training, career development and other support
- Respect for employee, gender and human rights in mining, and the removal of obstacles to participation in the mining sector on the basis of gender, marital status or disability
- Encouraging a more pro-active role for women in decisions relating to minerals and mining at the national, local and firm level
- Encouraging mining companies to develop a participatory and collaborative approach to mine planning, development and decommissioning, taking into account the needs of local communities
- Developing streamlined and effective institutional arrangements for the mining sector, together with adequate capacity to gather, analyse and disseminate geo-data, and promote, authorise, monitor and regulate mining operations
- Facilitation by Government institutions of community participation among other things by removing impediments to free expression and providing for the dissemination of information to the public on all aspects of mining as a basis for informed participation
- Acting in harmony with regional and international partners and, to this end, endorsing and implementing principles that are established in regional and international conventions and other instruments and undertakings that are relevant to mining and to which Ghana is a party or signatory, including banning trade in minerals from illicit sources

(2) Mineral Resources in the Study Area

According to the mineral occurrence map, the eastern belt of acidic gneiss consists mainly of the grained metamorphosed rocks rather richer in minerals than the rocks in the western belt and with many fewer quartz veins. Recent alluvium occupies the Volta River flood plains and the valleys of the major streams on the plain. The mineral occurrence map of the Study Area is

shown in Figure 2-24.



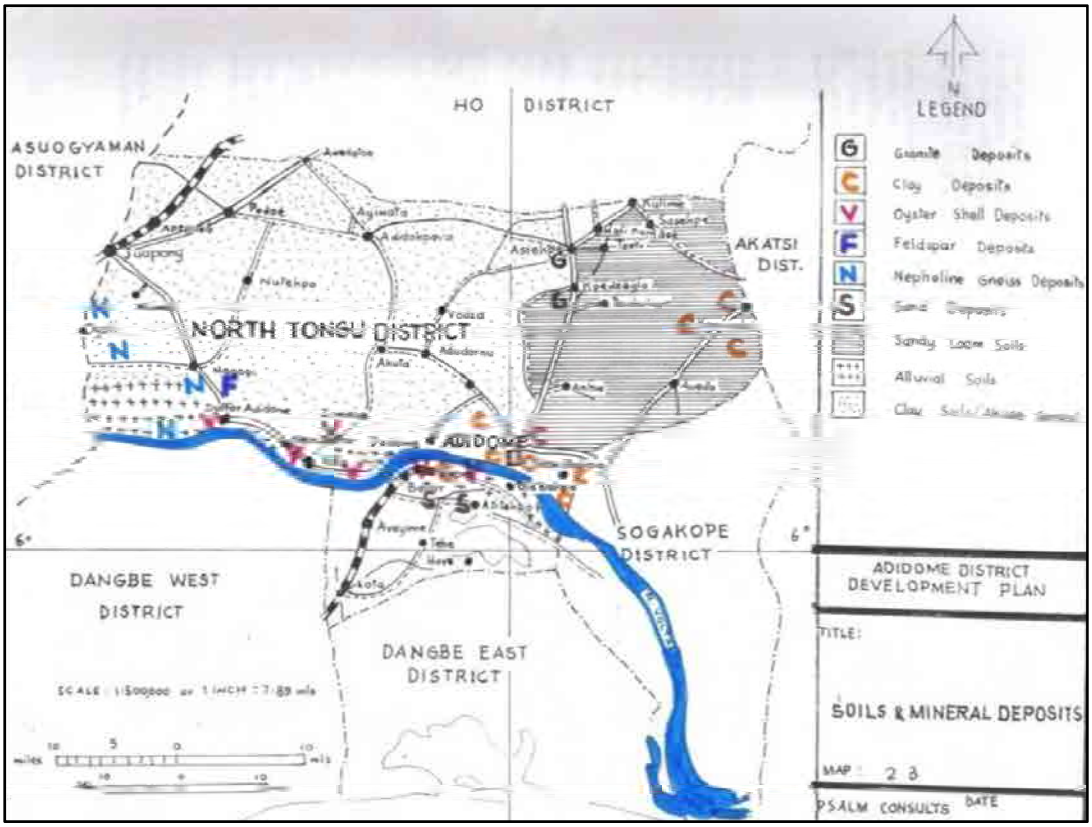
Source: Geological Survey Department of Ghana

Figure 2-24 Mineral Occurrence Map of the Study Area

(3) Mining Activities in the Study Area

The major mining deposits in the Study Area mostly lie along the Volta River, however, there is no mineral deposit of commercial and economic value except for clay, granite for aggregates, oyster shell, feldspar, Nepheline Gneiss, sand and granite as shown in Figure 2-25. Table 2-27 shows the general usage of the major mining deposits in the Study Area.

Regarding regional development for the Study, it will be possible to promote the mining industry in the Study Area, except granite quarries currently in operation in Dangme West District, by constructing a new section of the Eastern Corridor, even though the potential is much lower than that of the western side of the country.



Source: MTDP of North Tongu District

Figure 2-25 Mineral Deposits in North Tongu District

Table 2-27 General Usage of Minerals from the Mineral Deposits in the Study Area

Type of Mineral	General Usage
Clay	Manufacture of bricks and tiles, ceramic products and local pottery products
Oyster shells	Paint materials and animal feed
Feldspar	Glaze manufacture
Nepheline Gneiss	Glass, ceramic and porcelain wares
Sand	Construction industry
Granite	Construction industry as fine unexploited aggregates

Source: MTDP of North Tongu District

2.7.3 Tourism Sector

(1) Tourism Development Policy for Ghana

The tourism sector is one of the primary industries contributing to national income. The National Tourism Development Policy and Structural Plan (NTDPSP) provides the framework for developing integrated and sustainable tourism over the long term in Ghana.

In the NTDPSP 1996–2010, the goals, policy framework and guideline provide the conceptual basis for the planning, development, promotion and management of Ghana's tourism sector. The goal and framework of the tourism development policy for Ghana are summarised in Table 2-28.

Table 2-28 Policy Goal and Framework of Tourism Development Policy

Policy Goal
The tourism policy goal of Ghana is to develop tourism as a leading socio-economic sector of the country and a good quality, internationally competitive tourist destination, while maintaining its permanent sustainability
Policy Framework
▪ Tourism will be developed as one of the major socio-economic sectors of the country, generating substantial foreign exchange earnings, income, employment and government revenues. ▪ The socio-economic benefits of tourism must be distributed widely throughout the country. ▪ Tourism must be developed in a manner that helps achieve conservation of the country's cultural, historical and environmental heritage. ▪ Tourism must be developed on a sustainable basis. ▪ Tourism must be carefully planned, developed and managed. ▪ Tourism development must be comprehensive based on attractions, facilities, services and marketing. ▪ Tourism of good quality must be developed with international competitiveness. ▪ Planning and programming must be integrated into the overall national, regional and local development policy. ▪ The policy must be integrated with those of ECOWAS, other African countries, the World Tourism Organization and other relevant international organisation.

Source: NTDPSP

(2) Tourism Development Structure Plan

The tourism development structure is based on the policy, marketing analysis, survey and evaluation of tourist attractions and activities, existing development patterns, and other considerations. The plan integrates tourism zones, tourist gateways, tourism centres and tourist stopovers. Figure 2-26 illustrates the tourism development structure plan, and Table 2-29 lists the definitions of the plan.

Table 2-29 Definitions of the Tourism Development Structure Plan

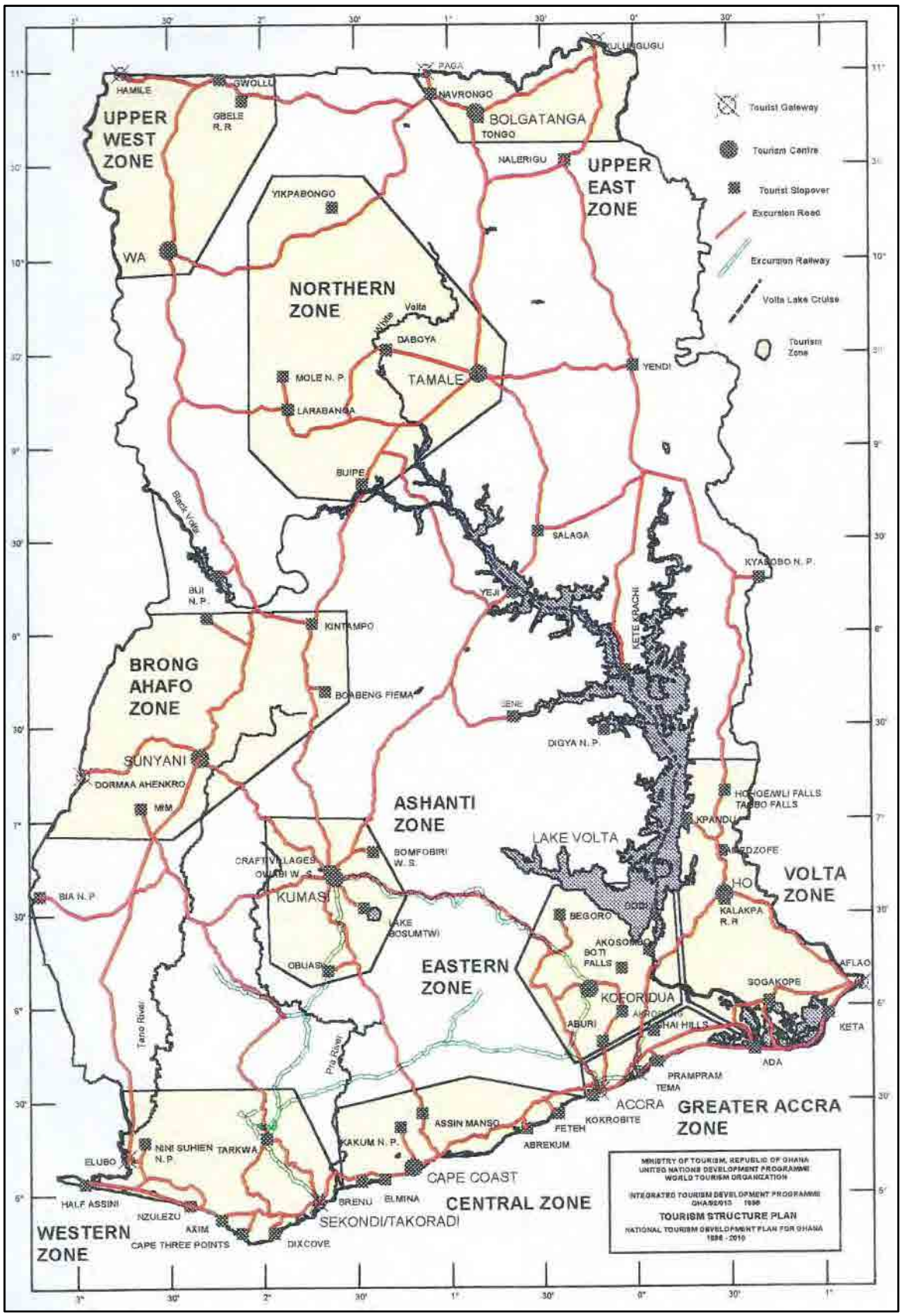
Name	Definition
Tourism Development Zone	The tourism development zones are areas that include a variety of tourism facilities and services and several tourist attractions linked together by a good transportation network to form an integrated tourism structure.
Tourist Gateway	Tourist gateways are the places of entry for international and regional tourists to the country.
Tourism Centre	Tourism centres are cities and towns located in tourism development zones that provide a concentration of accommodation, other tourist facilities and services and attractions.
Tourist Stopover	Tourist stopovers are places of touristic interest and provide some tourist facilities and services located along or near tourism excursion routes.
Tourist Excursion Route	Tourist excursion routes are road, railway, air and river transportation routes that connect tourism zones, tourism centres, and tourist stopovers.

Source: NTDPSP

From the structural plan given above, it is clear that the Study Area covers three tourism development zones: the Volta Development Zone, Eastern Development Zone and Greater Accra Development Zone. The characteristics of each zone are summarised and the locations of tourist attractions in the Study Area are shown in in Table 2-30.

(3) Proposed Project

Related to the development of roads and highways, the National Tourism Development Plan has designated projects for constructing rest stops throughout the country along existing highways. One such rest stop, named Linda Door, is located on N6 between Accra and Kumashi (Photos 2-15 and 2-16).

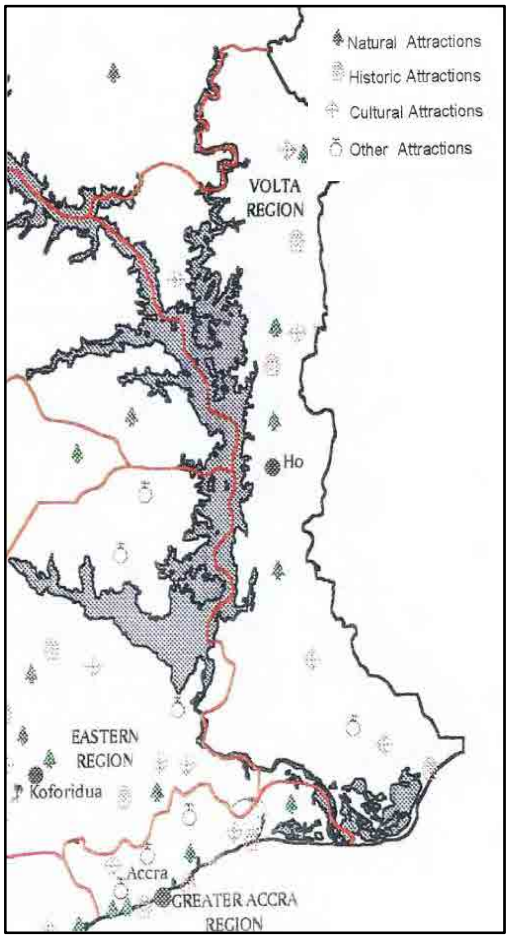


Source: NTDPSP

Figure 2-26 Tourism Development Structure Plan

Table 2-30 Major Tourism Elements in the Study Area

Zone Name	Major Tourism Element
Volta Development Zone	▪ Wli Falls (in Agumatsa Wildlife Sanctuary): waterfall landscape ▪ Tagbo Falls (in Agumatsa Wildlife Sanctuary): waterfall landscape ▪ Amedzofe : mountain views, hiking, horse riding ▪ Kpandu: architecture built in the German period ▪ Kete-Krachi: boat cruise ▪ Kalakpa Resource Reserve: potential wildlife attraction ▪ Mount Gemi: scenic views ▪ Sogakope: boat cruise ▪ Fort Prinzenstein (in Keta): historical building ▪ Volta Estuary: potential for sport game fishing ▪ Kyabobo National Park: scenic excursion ▪ Yam festival (Ho Municipal)
Eastern Development Zone	▪ Volta Dam: scenic views ▪ Volta Lake: scenic views, boat cruise ▪ Adomi bridge: scenic views ▪ Koforidua: potential tourist centre ▪ Ghana folk village: scenic attraction ▪ Aburi Botanical Garden: scenic views, historical hotel building ▪ Akropong-Mampong-Larteh: historical scene ▪ Presbyterian mission school building: historical building ▪ House of Tetteh Quarshie: the first cocoa farm ▪ Akwapin Ridge: scenic views ▪ Akonedi Shrine (Larteh): historical scene ▪ Boti Falls: scenic views ▪ Begoro: three water falls, scenic views
Greater Accra Development Zone	(Metropolitan area) National Museum, National Theatre, National Cultural Centre, Makola market, Accra Zoo, Campus of University of Ghana, areas of historic building, KwameNkrumah Mausoleum, independence square. (Historic Building) Jamestown area including the national monument of Ussher Fort, James Fort (Others) Shai Hills Resource Reserve: scenic views Densu River Delta, Panbro Salt Pans, Sakumo Lagoon: Ramsar wetland Tema Harbour: a largest seaport in West Africa Prampram, New Ningo: beach



Source: NTDPSP

The facilitates include restrooms, restaurant, canteen, agricultural product market and mosque. The parking lot is large enough to park five to ten tourist buses. There facilities were built under a public private partnership (PPP) scheme.

The proposed project has already identified 20 sites throughout the country, and the Eastern Corridor would enable another rest stop to be added between Astuare Jct. and Asikuma Jct.

Photo 2-15 Rest Stop in Linda Door (restaurant and canteen)

Photo 2-16 Rest Stop in Linda Door (food stand)

Photos by the Study Team, September 2012

(4) Tourism Potential in the Study Area

Although there are various tourism resources and space for new tourist facilities in the Study Area, many tourist attractions remain undeveloped due to lack of access roads. Construction of a new road section between Asutsuare Jct. and Asikuma Jct. will boost the tourist industry in the Study Area, including promoting eco-tourism. The planned bridge over the Volta River would itself be a new tourist attraction, providing a dynamic and harmonised landscape of the bridge structure over the river and the Osuyongwa Mountains. This may lead to the development of resort hotels along the Volta River similar to those at the Lower Volta Bridge in Sogakope and Adomi Bridge in Atimpoku. The new tourist centre would also encourage marine sports such as boat cruises or river canoeing on the clear waters of the Volta River.

2.8 Major Development Projects in the Study Area

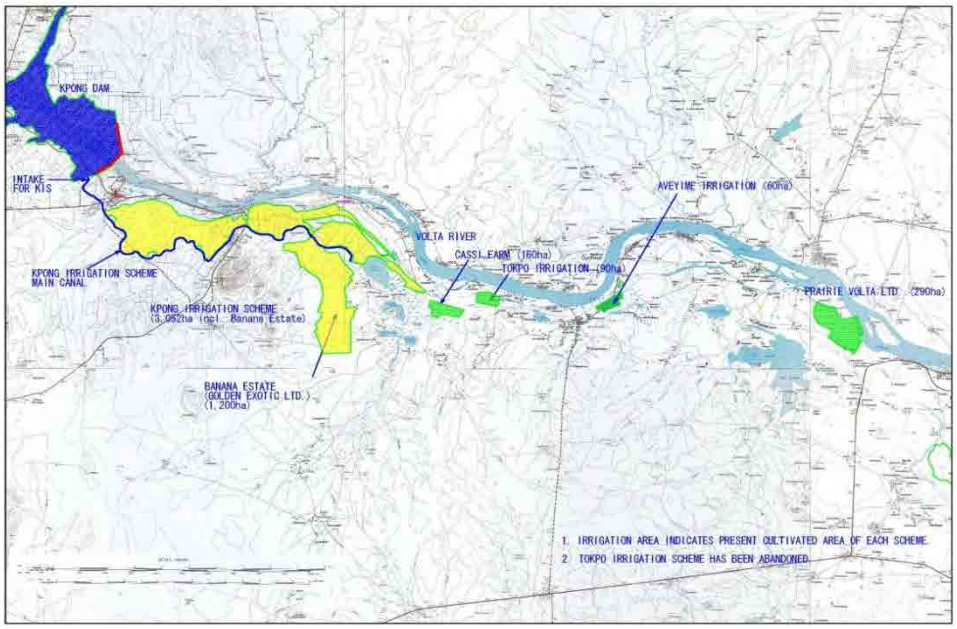
(1) Existing Irrigation Scheme

Agricultural development along the Volta River started in 1982 with the Kpong Irrigation Scheme (KIS) executed by the GIDA, which provides irrigation water to 3,113 ha of cultivated land, including 1,200 ha of banana estate operated by Golden Exotic Ltd. The KIS covers the area between Akuse and the eastern part of Asutsuare (near Volivo township) with 41 km of the main canal intake water from the Kpong Dam reservoir. Figure 2-27 illustrates the main canal and irrigated area by the KIS.

(2) Planned and On-going Agricultural Development Projects

a) Accra Plains Gravity Irrigation Project

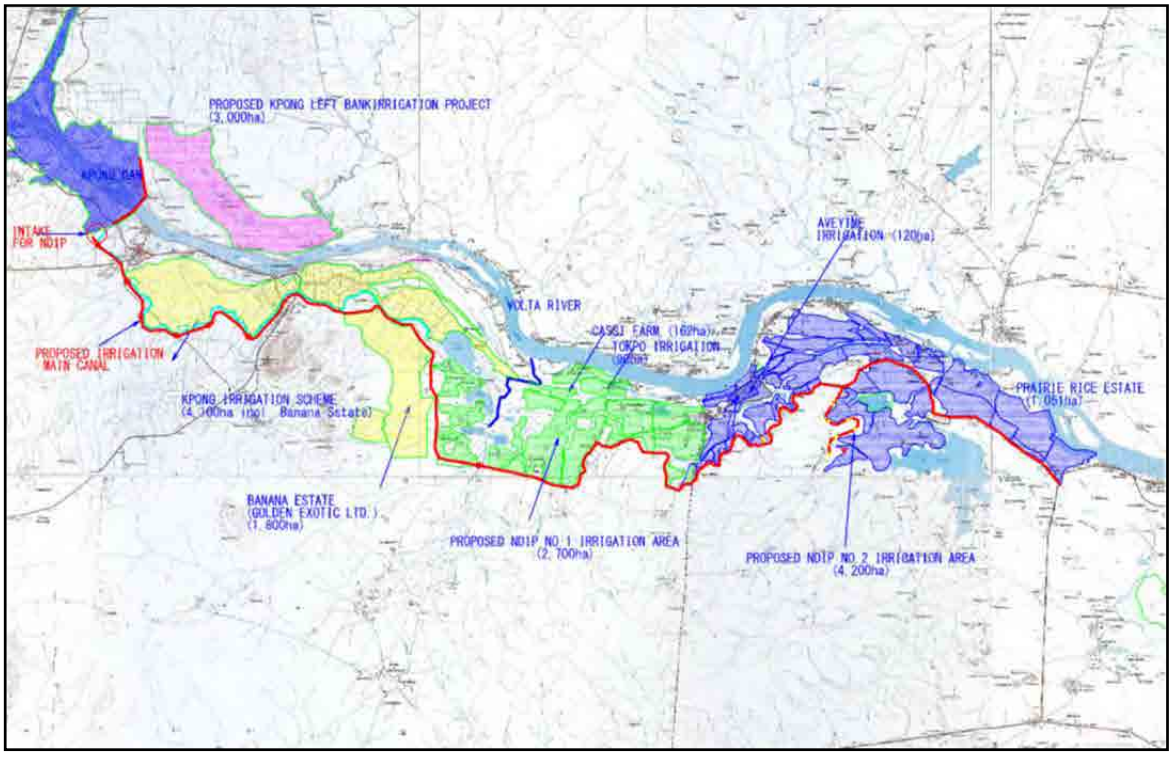
The Accra Plains cover about 156,000 ha (approximately 200,000 ha) along the right bank of the lower Volta River. A feasibility study for the whole Accra Plains area for irrigation development was conducted from 2008 to 2010 with the assistance of the Kuwait Fund with a pump irrigation system. Then, JICA conducted a pre-feasibility study to develop the gravity irrigation development plan to achieve double cropping of irrigated rice, the so-called Accra Plains Gravity Irrigation Project (APGIP), and completed the study in May 2011.



Source: Pre-Feasibility Study Final Report, Preparatory Study on Accra Plain Irrigation Development Project, May 2011, JICA

Figure 2-27 Existing Kpong Irrigation Scheme

The basic concept of the APGIP is to upgrade the existing KIS and extend the irrigation canal up to N1. The planned area east of the KIS is defined as the New Development Irrigation Scheme (NDIS). Figure 2-28 outlines the APGIP. The planned irrigated area by the APGIP is 4,100 ha for the expanded KIS area and 6,900 ha for NDIS.



Source: GIDA

Figure 2-28 Outline of the Accra Plain Gravity Irrigation Project

The GoG and development partners have been negotiating for the implementation of the

APGIP.

One of the largest agricultural developments in this irrigation project is located in Aveyime in the North Tongu District, known as the Aveyime Irrigation Scheme. The 120 ha. project as started in 1962 and will end next year, however, the irrigation facilities were damaged in 1998 and repairs were finally completed in 2010. The major agricultural product is rice, and the project was mainly undertaken by a private company, Prairie Volta Ltd., using a PPP scheme. Even though the main to the east of the project area from the Kpong Dam has not yet been constructed, private companies have built their own irrigation pumping systems to convey manage water from the Volta River to their field. Completion of the main canal and access roads would help private companies to expand their agricultural areas quickly and small- and medium-scale farmers to develop new crop fields on the eastern side of the project area.

b) Kpong Left Bank Irrigation Project

Apart from the APGIP, the GIDA is implementing the Kpong Left Bank Irrigation Project (KLBIP), with financial assistance of the MCC, and jointly working with a Kenyan company Vegpro under a PPP scheme. The location of the KLBIP is shown in pink in Figure 2-28. The total area of the project is 3,000 ha, of which the GIDA covers 450 ha. The remaining area is going to be developed by Vegpro with a pumping irrigation system for the cultivation of baby corns and Bird's Eye chillies exclusively for export to the UK.

c) Small Scale Irrigation Scheme

Currently there are three Small Scale Irrigation Schemes (SSIS) underway in North Tong District, as listed in Table 2-31. These projects stared in only recently compared to those on the left bank of the Volta River, and are still underway. One of the reasons for this is severe damage to a pumping facility caused by inundation of the Volta River during overflow from the Kpong and Akosombo Dam in 2010. The farmers' association in this district, Irrigation Farmers Association (IFA), is powerful and manages the irrigation project and the completion of the v community. Although this too could be a reason for the delay of the project, the unity of the agricultural community brings stability and reduces the risk of a collapse in communication between communities and enhances human resources.

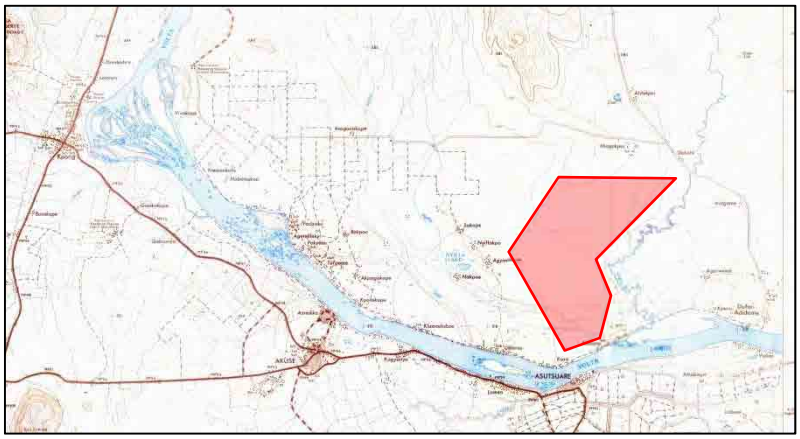
Table 2-31 Small Scale Irrigation Scheme

Project	Location	Period	Available Facilities	Beneficiaries	Irrigated Area (ha)	Funding Agency
Agoryeme Small-Scale Irrigation Scheme	Agoryeme	1999 - 2006	- Pump house fitted with pumps - Secondary and tertiary canal - North storage reservoir - Drying floor	IFA in the community	103	GoG AfDB
Volo Small-Scale Irrigation Scheme	Volo				206	
Afaode Small Scale Irrigation Scheme	Afaode				50	

Source: MoFA

d) Agricultural Development by Israel Company

On the eastern side of the KLBIP, an Israeli company, PE-AVIV, has already started an agricultural development scheme with 5,000 ha of land. Figure 2-29 shows the approximate location of this scheme. According to PE-AVIV, they have developed a pumping irrigation system, and are going to cultivate maize and vegetables (some of them will be produced in green-houses), initially for domestic consumption.



Source: Study Team

Figure 2-29 Location of Agricultural Development by PE-AVIV

e) Banana Estate Expansion Programme

Golden Exotic Ltd., which operates 1,200 ha of banana estate, plans to add 600 ha. of estate on the south-western side adjacent to their existing estate. Their products are exclusively exported to the UK and France. According to Golden Exotic Ltd. they are also interested in expanding their estate on the eastern side of the Alabo River on the left bank of the Volta River.

f) Paddy Field Development

On the eastern edge of APGIP, an Israeli company has already started to develop the Prairie Rice Estate with 1,051 ha of land. The location of this estate is shown in Figure 2-28. Another paddy field development is underway near Yorkutikpo township along the R28 Sugakope – Ho road. Details of these paddy field developments are not yet available to the Study Team.