

APPENDICES

• Appendix 1 POCC Analysis of MTDP and Development Goal of POCC

Table A1-1 POCC Analysis of MTDP of Ho Municipality

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
<ul style="list-style-type: none"> ▪ Inadequate development of, and investment in processing and added value of traditional food crops and cash crops such as cassava and oil palm 	<ul style="list-style-type: none"> ▪ Existence of viable market ▪ Availability of vast arable land ▪ Availability of water for irrigation ▪ Large labour force ▪ Existence of NBSSI 	<ul style="list-style-type: none"> ▪ Existence of MoFA ▪ Availability of agricultural extension services ▪ Existence of MASLOC ▪ Support from MA 	<ul style="list-style-type: none"> ▪ Low income levels of farmers ▪ Lack of collateral security ▪ Land disputes in some areas ▪ Unwillingness of youth to go into agriculture. 	<ul style="list-style-type: none"> ▪ Culture of low loan repayment ▪ Low promotion of added value ▪ Low investment in food processing
<p>Conclusion: There are sufficient resources such as a viable market, vast arable land, and agricultural extension services to address the constraints and challenges. In addition the NBSSI would be extensively involved in dialogue to deal with the constraints and challenges</p>				
<ul style="list-style-type: none"> ▪ Difficulty in accessing large tracts of land 	<ul style="list-style-type: none"> ▪ Availability of vast land for development ▪ Existence of traditional leaders and opinion leaders 	<ul style="list-style-type: none"> ▪ Creation of land bank ▪ Land administration project 	<ul style="list-style-type: none"> ▪ Most lands is small scale owned by families ▪ Land disputes and litigation 	<ul style="list-style-type: none"> ▪ Difficult to engage in mechanised and large-scale farming
<p>Conclusion: The existence of traditional leaders and opinion leaders, vast land, creation of a land bank as well as land administration project means there is sufficient potential and opportunities to support the programme to address the constraints and challenges.</p>				
<ul style="list-style-type: none"> ▪ Low agricultural productivity and output due to dependence on rainfall 	<ul style="list-style-type: none"> ▪ Availability of arable land ▪ Volume of water available for irrigation ▪ Presence of workforce ▪ Availability of organic manure 	<ul style="list-style-type: none"> ▪ Availability of market for crops especially horticultural crops 	<ul style="list-style-type: none"> ▪ Land litigation ▪ Low rate of adoption of improved technologies ▪ Inadequate and untimely release of credit ▪ Insufficient number of extension staff 	<ul style="list-style-type: none"> ▪ Erratic rainfall pattern ▪ High cost of irrigation and agricultural inputs
<p>Conclusion: A project to increase crop production is feasible project. There are rivers as natural resources to support the project. The constraints and challenges would be managed through improved technology and dialogue.</p>				
<ul style="list-style-type: none"> ▪ Low access to irrigated land 	<ul style="list-style-type: none"> ▪ Existence of the MA ▪ Availability of traditional authorities ▪ Existence of farmer groups 	<ul style="list-style-type: none"> ▪ Existence of NGOs to support 	<ul style="list-style-type: none"> ▪ Low income levels of farmers 	<ul style="list-style-type: none"> ▪ Socio-cultural beliefs ▪ Outmoded customs
<p>Conclusion: Access to irrigation land by farmers for farming is feasible in the municipality. The constraints and challenges would be managed by involving all stakeholders</p>				
<ul style="list-style-type: none"> ▪ Inadequate credit support facilities for agricultural production 	<ul style="list-style-type: none"> ▪ Existence of organised agricultural groups ▪ Presence of banks 	<ul style="list-style-type: none"> ▪ Existence of MASLOC, MCA and NGOs 	<ul style="list-style-type: none"> ▪ Unwillingness of banks to support agricultural sector 	<ul style="list-style-type: none"> ▪ Delay and untimely release of credit by donors
<p>Conclusion: Credit facilities to support the agricultural sector are a viable project in the municipality. The constraints and challenges would be addressed by bringing all stakeholders on board.</p>				
<ul style="list-style-type: none"> ▪ High post-harvest losses 	<ul style="list-style-type: none"> ▪ Availability of land to establish processing factories ▪ Agricultural extension agents and NGOs to give education on food storage ▪ Availability of ready market 	<ul style="list-style-type: none"> ▪ Government policy to buy and store farm produce ▪ Existence of MA and development partners to build storage facilities 	<ul style="list-style-type: none"> ▪ Unattractive prices during certain seasons of the year ▪ High cost of storing chemicals 	<ul style="list-style-type: none"> ▪ Insufficient subsidies for agricultural inputs ▪ Delay in government policy implementation
<p>Conclusion: The project would be successful because the numerous economic and social resources listed offer significant potential and opportunities to address the problems. Negotiations and dialogue would also be actively used to engage all stakeholders as part of addressing the constraints and challenges.</p>				

Source: Volta Region Coordinating Council

Table A1-2 Development Goals of POCC of Ho Municipality (1)

Thematic Area	Agriculture Modernisation and Natural Resource Management
Key Focus Area	<ul style="list-style-type: none"> ▪ Accelerated Modernisation of Agriculture ▪ Climate Variability and Change ▪ Land degradation and Land use ▪ Waste Pollution and noise
Objectives	<ul style="list-style-type: none"> ▪ To enhance agricultural extension service delivery. ▪ To increase access of farmers to modern agricultural technology. ▪ To build the operational capacity of farmers along the value chain. ▪ To identify and develop commodities of competitive and comparative advantage. ▪ To adapt to the impacts and reduce vulnerability to climate variability and change ▪ To maintain and enhance the Protected Area system.
Policies	<ul style="list-style-type: none"> ▪ Improve agricultural productivity ▪ Increase agricultural competitiveness and enhance integration into domestic and international markets ▪ Adapt to the impacts and reduce vulnerability to climate variability and change. ▪ Mitigate the impacts of climate variability and change ▪ Curb the loss of bio-diversity by strengthening safe and sound environmental practices ▪ Reverse land and natural resources degradation through investment ▪ Achieve sustainable use of wetlands and water resources
Strategies	<ul style="list-style-type: none"> ▪ Provide agricultural land banks for youths in agriculture in the municipality ▪ Introduce high-yielding crop varieties and improved breeds of animals to farmers ▪ Provide irrigation schemes in the municipality ▪ Re-introduce aqua-culture in the municipality ▪ Introduce appropriate technologies such as dryers to farmers in the municipality ▪ Increase the ratio of agricultural extension agents to farmers. ▪ Increase access to credit to farmer-based organisations in the municipality ▪ Provide markets and storage facilities in the municipality ▪ Establish cassava processing and drying centres in all zonal councils ▪ Promote agro-based industries in the municipality ▪ Train unemployed youths annually in snail and mushroom production. ▪ Facilitate the establishment of mechanisation services provision centres, and machinery hire purchase and lease schemes with backup spare parts for all machinery and equipment. ▪ Develop human capacity in agricultural machinery management, operation and maintenance within the public and private sectors. ▪ Promote the accelerated development of feeder roads and rural infrastructure ▪ Develop trade in local and regional markets ▪ Improve market infrastructure and sanitary conditions ▪ Increase resilience to climate change impacts: through early warning systems ▪ Minimise climate change impacts on human health through improved access to healthcare ▪ Improve waste management mechanisms ▪ Promote energy efficiency in all aspects of social and economic life ▪ Encourage reforestation of degraded forest and off- reserve areas through the plantations development and afforestation programmes ▪ Encourage the use of lesser used species (LUS), particularly for the construction industry in the domestic market ▪ Carry out comprehensive wetlands inventory, supported by research and monitoring ▪ Educate the public on the outcome of improper disposal of waste ▪ Provide waste collection bins at suitable places in the communities, and empty these bins ▪ Regularly enforce all sanitation laws

Table A1-2 Development Goals of POCC of Ho Municipality (2)

Thematic Area	Infrastructure, Energy and Human Settlement
Key Focus Areas	<ul style="list-style-type: none"> ▪ Transport Infrastructure ▪ Information Communication technology for Growth ▪ Recreation Infrastructure ▪ Energy supply to support industries and households ▪ Renewal energy ▪ Human Settlements Development ▪ Housing and Shelter ▪ Water and Environmental sanitation and hygiene
Objectives	<ul style="list-style-type: none"> ▪ To expand the transport infrastructure into farming communities with emphasis on feeder roads and farm tracks. ▪ To promote the rapid development and deployment of the national ICT infrastructure ▪ To develop recreational facilities and promote cultural heritage and natural conservation in both urban and rural areas ▪ To ensure increased access of households and industries to efficient, reliable and adequate energy supply ▪ To promote the sustainable, spatially integrated and orderly development of human settlements for socio-economic development ▪ To promote well structured and integrated urban development ▪ To increase access to safe, adequate and affordable shelter ▪ To accelerate the provision of affordable and safe water ▪ To improve environmental Sanitation.
Policies	<ul style="list-style-type: none"> ▪ Create and sustain an efficient transport system that meets user needs ▪ Promote the application of science, technology and innovation in all sectors of the economy ▪ Integrate land use, transport planning, development planning and service provision (science, technology and innovation to support productivity and development) ▪ Promote information communication technology development for growth ▪ Promote well structured and integrated urban development ▪ Increase access to safe, adequate and affordable shelter
Strategies	<ul style="list-style-type: none"> ▪ Prioritise the maintenance of existing road infrastructure to reduce vehicle operating costs (VOC) and future and rehabilitation costs ▪ Implement Integrated Land use and spatial planning ▪ Promote science, technology and innovation development at all levels of production ▪ Decongest and reverse the decline in productivity of primary cities and selected fast growing settlements ▪ Promote urbanisation as a catalyst for economic growth, social improvement, and environmental sustainability ▪ Provide versatile spaces in urban areas for commercialisation ▪ Create land banks to ensure the availability of serviced lands for housing development at affordable prices ▪ Acquire and develop land/sites for the treatment and disposal of solid waste in major towns and cities

Source: Volta Region Coordinating Council

Table A1-3 POCC Analysis of MTDP of Adaku-Anygbe District

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
<ul style="list-style-type: none"> ▪ Low access of women to land including irrigated land 	<ul style="list-style-type: none"> ▪ Existence of streams and rivers for irrigation 	<ul style="list-style-type: none"> ▪ Favourable government policy on agriculture and employment of women 	<ul style="list-style-type: none"> ▪ Inadequate dams ▪ Low rainfall pattern in the district ▪ Inadequate funds to construct dams/dug-outs 	<ul style="list-style-type: none"> ▪ Limited financial/credit institutions ▪ Harsh collateral requirements ▪ Poor rainfall pattern
<ul style="list-style-type: none"> ▪ Credit support facilities for agricultural production 	<ul style="list-style-type: none"> ▪ Existence of financial institutions ▪ Existence of FBOs 	<ul style="list-style-type: none"> ▪ Favourable government policy ▪ Favourable interest rate 	<ul style="list-style-type: none"> ▪ Inadequate credit institutions ▪ Low loan recovery rate ▪ Misappropriation of loan facilities 	<ul style="list-style-type: none"> ▪ Hash collateral requirements ▪ Untimely release
<ul style="list-style-type: none"> ▪ Low level of mechanisation due to limited availability and access to appropriate agricultural machinery, equipment and mechanised services ▪ High cost of agricultural machinery and equipment ▪ Inadequate technical know-how in agricultural mechanisation ▪ Inadequate post-production infrastructure 	<ul style="list-style-type: none"> ▪ Existence of district directorate of agriculture 	<ul style="list-style-type: none"> ▪ Govt. policy to establish tractor pool ▪ Availability of hire purchase facility at MoFA 	<ul style="list-style-type: none"> ▪ Absence of agriculture technology school ▪ Inadequate agricultural officers ▪ Non-availability of agriculture machinery service centres. 	<ul style="list-style-type: none"> ▪ Inadequate budgetary support from government
<ul style="list-style-type: none"> ▪ Poor nature of roads to production centres ▪ Inadequate market information ▪ Limited marketing extension for producers, traders and exporters 	<ul style="list-style-type: none"> ▪ Existence of road network ▪ Existence of feeder roads ▪ Existence of internet services 	<ul style="list-style-type: none"> ▪ Access to Road Fund ▪ Donors (DANIDA, MCC) ▪ Existence of telecommunication networks 	<ul style="list-style-type: none"> ▪ Inadequate IT centres in the district ▪ Inadequate local resources 	<ul style="list-style-type: none"> ▪ Delay in release of funds for road construction and maintenance
<ul style="list-style-type: none"> ▪ High incidence of poverty among farmers, especially food crop farmers 	<ul style="list-style-type: none"> ▪ Large tracts of farm-land ▪ Availability of market ▪ Cross- border trade 	<ul style="list-style-type: none"> ▪ Favourable government. policy on agriculture 	<ul style="list-style-type: none"> ▪ Small scale farming ▪ Difficulty in accessing credit for farming ▪ Labour intensive farming ▪ Rain-fed agriculture 	<ul style="list-style-type: none"> ▪ Inadequate funds for poverty reduction projects/programmes ▪ Delay in release of funds
<ul style="list-style-type: none"> ▪ Poor management practices (feeding and health care) and low productivity ▪ Inadequate availability of quality feed ▪ Inability of local livestock farmers to match the stiff competition from cheap imports ▪ Low awareness of food safety leading to practices such as use of inappropriate handling, transportation of livestock/livestock products ▪ Poor quality of data and monitoring system 	<ul style="list-style-type: none"> ▪ Availability of agriculture extension services ▪ Organised livestock associations ▪ Large tract of grazing land 	<ul style="list-style-type: none"> ▪ Existence of animal research institutes ▪ Availability of livestock development projects 	<ul style="list-style-type: none"> ▪ Poor grazing land and supplementary feeding ▪ Culture of free range management system 	<ul style="list-style-type: none"> ▪ Inadequate agricultural extension staff ▪ Inadequate logistics for monitoring
<p>Conclusion: Agriculture is the major economic activity in the district. To accelerate the modernisation of agriculture and agro-based industrial development, the district needs to make maximum use of the prevailing government policy on agriculture modernisation. In addition, the lakes and rivers can be used for effective irrigation farming.</p>				
<ul style="list-style-type: none"> ▪ Poor nature of roads 	<ul style="list-style-type: none"> ▪ Availability of skilled labour ▪ Availability of road network ▪ Existence of DFR 	<ul style="list-style-type: none"> ▪ Access to LSDGP and CBRDP 	<ul style="list-style-type: none"> ▪ Low internally generated funds 	<ul style="list-style-type: none"> ▪ Delay in release of govt. and donor funds ▪ Delay in the implementation of donor projects
<ul style="list-style-type: none"> ▪ Increase in road traffic accidents ▪ Inadequate enforcement of road transport regulations 	<ul style="list-style-type: none"> ▪ DFR ▪ Existence of DVLA ▪ Existence of security agencies 	<ul style="list-style-type: none"> ▪ National campaign on road transport regulations 	<ul style="list-style-type: none"> ▪ Absence of road signs ▪ Heavy traffic on roads ▪ Narrow width of major roads 	<ul style="list-style-type: none"> ▪ Inadequate resources to enforce road regulation
<p>Conclusion: The main issue under the thematic area is inadequate production infrastructure especially road and sanitation infrastructure, and the constraints and challenges of making adequate resources available for providing infrastructure in the district. Fortunately, the LSGDP is accessible at the district level and the existence of relevant institutions such as the DFR, town planning and environmental health in the district can facilitate improvement of production infrastructure in the district. The DA needs to provide resource town planning and the security agencies must strictly enforce the building regulations in the district.</p>				

Source: Volta Region Coordinating Council

Table A1-4 Development Goals of POCC of Adaku-Anygbe District

Thematic Area	Agriculture Modernisation and Natural Resource Management
Objectives	<ul style="list-style-type: none"> ▪ To reduce the risk associated with agriculture
Strategies	<ul style="list-style-type: none"> ▪ Develop appropriate irrigation schemes, dams, boreholes and other water harvesting technologies for different categories of farmers ▪ Promote access to land by women ▪ Provide selective subsidies for the agricultural sector for the procurement of improved seeds, grade breeders and stock, pesticides and fertilisers ▪ Create awareness about environmental issues among all stakeholders and develop an effective and efficient framework for collaboration with appropriate agencies to ensure environmental compliance ▪ Improve incentives and compulsion measure 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
Objectives	<ul style="list-style-type: none"> ▪ To improve agriculture productivity
Strategies	<ul style="list-style-type: none"> ▪ Develop human capacity in agricultural machinery management, operation and maintenance within the public and private sectors ▪ Promote the production and use of small-scale multi-purpose machinery along the value chain, including farm level storage facilities, appropriate agro-processing machinery/equipment and intermediate means of transport
Objectives	<ul style="list-style-type: none"> ▪ To increase competitiveness and enhanced integration into domestic and international markets
Strategies	<ul style="list-style-type: none"> ▪ Improve market infrastructure and sanitary conditions ▪ Promote the formation of viable farmer groups and FBOs to enhance their knowledge, skills and access to resources along the value chain, and to strengthen bargaining power in marketing ▪ Promote selected crops for food security, export and support to industry ▪ Promote the development of selected horticulture and exotic vegetables for export ▪ Promote small-holder productivity in the transition to large-scale production ▪ Extend the concept of nucleus out-grower and block farming schemes and contract farming to cover staple and horticulture crops to bridge the gap between large- and small-scale producers ▪ Promote the linkage of smallholder production to industry
Objectives	<ul style="list-style-type: none"> ▪ To promote livestock and poultry development for food security and income
Strategies	<ul style="list-style-type: none"> ▪ Improve access to quality feed ▪ Develop commercial poultry as the priority for improving meat supply ▪ Introduce measures to transform smallholder production into profitable enterprises ▪ Increase the awareness of food safety and public health ▪ Facilitate the development of livestock statistics and monitoring system ▪ Promote linkage relationships between animal and crop farmers to enhance bi-product utilisation
Thematic Area	Infrastructure, Energy and Human Settlement
Goal	<ul style="list-style-type: none"> ▪ To improve rural access to productive infrastructure
Objectives	<ul style="list-style-type: none"> ▪ To link 10 rural communities to major towns and market centres in the District
Strategies	<ul style="list-style-type: none"> ▪ Construct 50 km of feeder roads ▪ Upgrade 25 km feeder roads ▪ Rehabilitate major roads in the district

Source: Volta Region Coordinating Council

Table A1-5 POCC Analysis of MTDP of North Tongu District

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Poor Road Network	<ul style="list-style-type: none"> ▪ Existence of sector departments at the District Assembly; Department of Feeder Roads; Town and Country Planning Department. ▪ Availability of road construction materials e.g. stone and gravel. ▪ Willingness of communities to co-operate. 	<ul style="list-style-type: none"> ▪ Government of Ghana ▪ Road Fund. ▪ Donor grants. 	<ul style="list-style-type: none"> ▪ Inadequate monitoring and supervision. ▪ Inadequate maintenance ▪ Inadequate logistics for staff. 	<ul style="list-style-type: none"> ▪ Irregular flow of funds. ▪ No support from survey ▪ Department of Town and Country Planning Department.
Conclusion: Currently, there is many ways of improving the situation				
Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Absence of Sustainable Industrial Sector to generate employment	<ul style="list-style-type: none"> ▪ Vast land for large scale agro-business. ▪ Existing water bodies of the Volta River and its numerous tributaries, Alabo, Kolor, Aklakpa, Gblor and Nyivu for irrigation. ▪ DA support for access to two big market centres: Accra – Tema and Lome in Togo 	<ul style="list-style-type: none"> ▪ Government-supported Rural Enterprise Project ▪ NGOs, DANIDA, GTZ ▪ PSI for cassava and oil palm. 	<ul style="list-style-type: none"> ▪ Low level of entrepreneurial skills ▪ Inadequate access to credit facilities. ▪ Land litigation ▪ No plan defined for the district 	<ul style="list-style-type: none"> ▪ Poor road network ▪ Low level of energy supply (electricity and gas)
Conclusion: Currently, there are many ways of improving the situation				
Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Deteriorating soil fertility	<ul style="list-style-type: none"> ▪ Availability of cow dung ▪ Availability of chemical fertiliser retail shops ▪ Availability of agricultural information 	<ul style="list-style-type: none"> ▪ Existence of land and water management project ▪ Availability of the Soil Research Institute ▪ Existence of fertiliser importers 	<ul style="list-style-type: none"> ▪ Annual bushfires ▪ Continuous cropping ▪ Inappropriate cropping patterns ▪ Inappropriate land preparation operations 	<ul style="list-style-type: none"> ▪ Non-sustainability of land and water management project ▪ Inadequate release of funds ▪ High cost of fertilizer
Conclusion: Not available				
Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Low prices for agricultural produce	<ul style="list-style-type: none"> ▪ Emerging farmer group organisations ▪ Existence of Department of Cooperatives ▪ Availability of small-scale processors 	<ul style="list-style-type: none"> ▪ Existence of the President's initiative for cassava ▪ Existence of national consumers association ▪ Existence of Food Research Institute (FRI) 	<ul style="list-style-type: none"> ▪ No organised producers cooperatives ▪ Lack of farm-gate technology for storage of perishables ▪ Large numbers of farmers producing same commodity 	<ul style="list-style-type: none"> ▪ Ban on importation of some food commodities.
Conclusion: Not available				

Source: Volta Region Coordinating Council

Table A1-6 Objectives of POCC of North Tongu District

Thematic Area	Overall
Objectives	<ul style="list-style-type: none"> ▪ To increase revenue mobilisation and management by 20% by 2013 ▪ To improve and increase the basic socio-economic infrastructure development by 10% by 2013 ▪ To increase and promote extension services and the use of improved seeds from 40% to 60% by 2013 ▪ To promote effective private sector participation in the development of the district ▪ To improve the logistics and human resource based in the district ▪ To enhance good governance by strengthening the administrative set-up of the Assembly and the sub-structures. ▪ To promote economic activities in the District especially for the vulnerable and the excluded.

Source: Volta Region Coordinating Council

Table A1-7 POCC Analysis of MTDP of Dangme West District

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Increase access to irrigation schemes and promote mechanised farming in the District	<ul style="list-style-type: none"> ▪ Availability of land and water bodies for both small-scale and large-scale farming ▪ Availability of agriculture mechanisation centre to provide appropriate technology to farmers ▪ Availability of high yielding seedlings 	<ul style="list-style-type: none"> ▪ Closeness to Accra for marketing & export of produce ▪ Government support for non-traditional exports ▪ Availability of high-yielding seedlings ▪ MCA priority on agriculture transformation in the district and linkage to wider markets ▪ MCA support on the establishment of agro-processing industries in the district (including the construction of a pack house at Agomeda) ▪ Government intervention on the irrigation of 2,000 hectares of land for large-scale agriculture ▪ Available government support under the youth in agriculture programme 	<ul style="list-style-type: none"> ▪ Destruction of crops by cattle ▪ Unfavourable land tenure system 	<ul style="list-style-type: none"> ▪ Frequent bushfires ▪ The credit crunch and fear of limited funding in establishing agro-processing industries from partners ▪ Changing the mindset of farmers to see agriculture as a business ▪ High cost of agro-chemicals and irrigation infrastructure ▪ Drying up of rivers/ water bodies that feed the dams
<p>Conclusion: Utilizing the potential of the district for large-scale agriculture by the constructing irrigation facilities and establishing agriculture mechanisation centre would change the mindset of farmers, increase their productive capacity and reduce the high cost of agro-chemicals.</p>				

Source: Greater Accra Region Coordinating Council

Table A1-8 Development Goals of POCC of Dangme West District

Thematic Area	Agriculture Modernisation and Natural Resource Management
Objectives	<ul style="list-style-type: none"> ▪ To increase access to irrigation schemes and promote mechanised farming in the District
Strategies	<ul style="list-style-type: none"> ▪ Ensure equity and transparency in the distribution of irrigated land to avoid conflicts in the communities ▪ Protect dam walls from erosion by using appropriate measures e.g. Planting of vetiver grass, etc. ▪ Introduce appropriate fishing methods ▪ Encourage the formation of Water Users Associations to enhance the management of dam facilities and improve access to credit and other fund ▪ Encourage fencing of the dam to prevent livestock from getting into the dam ▪ Promote proper landscaping and slope protection measure to avoid siltation of dams that may lead to volume reduction ▪ Support the establishment of 2,000 hectares of irrigated land under the APGIP ▪ Facilitate the establishment of cold storage facilities in fishing communities ▪ Promote the use of both scientific and organic farming methods ▪ Collaborate with decentralised departments and agencies to train the youth in agriculture and other related services ▪ Organise farmers' workshops in four traditional areas ▪ Construct/rehabilitate 4 dams/dugouts in 4 communities ▪ Support the cultivation of traditional and non-traditional crops under the Youth in Agriculture Programme
Objectives	<ul style="list-style-type: none"> ▪ To improve the knowledge of farmers on the use of high yielding seedlings and application of agro-chemicals
Strategies	<ul style="list-style-type: none"> ▪ Promote improved management practices to maximise yield from introduced high-yielding crop varieties ▪ Develop marketing systems to motivate farmers to continue using high-yielding crops ▪ Ensure consumer preferences in the introduction of new varieties to ensure sustainability ▪ Promote appropriate strategies for bio-diversity conservation ▪ Train farmers and farmer-based groups in new technologies ▪ Provide logistics to and other incentives to Agriculture Extension Agents (AEAs) ▪ Support the eradication of pests and diseases ▪ Encourage the production of small ruminants ▪ Educate farmers on modern technologies and the importance and use of improved seedlings ▪ Provide demonstration farms in the District

Source: Greater Accra Region Coordinating Council

Table A1-9 POCC Analysis of MTDP of Dangme East District

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Poor irrigation facilities	<ul style="list-style-type: none"> ▪ Availability of water from the Volta River. ▪ Availability of large tract of arable land ▪ Co-operation and support from Production Societies and the District Agricultural Directorate 	<ul style="list-style-type: none"> ▪ Presence of NGOs and Development Partners ▪ The willingness of Government to support agricultural development ▪ The availability of Agricultural Development Banks 	<ul style="list-style-type: none"> ▪ Poor farmer knowledge on the use of irrigation facilities ▪ Inadequate Co-operative Societies to access funds for irrigation ▪ Protracted conflicts between farmer-based organisations 	<ul style="list-style-type: none"> ▪ Inadequate funds ▪ Unwillingness of Banks to give loans to undertake agricultural projects due to the high risks involved
<p>Conclusion: Agriculture in the district is mostly rain-fed with only a hand full of farmers having access to irrigational facilities. The District however has high potential for the provision of irrigation facilities due to the availability of water from the Volta River. Great effort is therefore needed to ensure that these potentials are adequately harnessed to enhance agricultural productivity in the District. There is also the need to foster synergy between farmer-based organisations and the Agricultural Directorate in order to ameliorate all agriculture related problems in the District.</p>				
Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Poor road network	<ul style="list-style-type: none"> ▪ Presence of the Department of Feeder roads and High ways. ▪ Availability of the DACF and DDF ▪ Availability of road construction and maintenance materials at Tehey and other areas in the District ▪ Co-operation and support from rural communities notwithstanding the low level of income in rural communities ▪ Availability of skilled and unskilled labour for road construction ▪ The presence of reputable and experienced road contractors in the District 	<ul style="list-style-type: none"> ▪ Existence of Ghana Road Fund and the presence of Development Partners with interest in roads infrastructure 	<ul style="list-style-type: none"> ▪ Inadequate personnel and lack of road maintenance equipment ▪ Poor road designs and execution techniques by contractors ▪ Unfavourable weather conditions and delay in project execution due to inadequate participation and change of priorities ▪ Inadequate involvement of women in road projects ▪ Inadequate maintenance practices due to inadequate funds 	<ul style="list-style-type: none"> ▪ Inadequate funds ▪ Delay in the release of funds
<p>Conclusion: Many of the roads in the District are feeder roads. It is extremely important to improve these roads in order to improve living conditions in the District. It is also expected that the existing potentials as well as an increase in the Road Fund by GoG will have a trickledown effect for improving roads in the District, because roads play a major role in the production, distribution and marketing of agricultural produce which form the bedrock of the economic activities of the people in the District.</p>				

Source: Greater Accra Region Coordinating Council

Table A1-10 Development Goals of POCC of Dangme East District

Thematic Area	Agriculture Modernisation and Natural Resource Management
Objectives	<ul style="list-style-type: none"> ▪ To improve agriculture productivity by 20% within the plan period
Strategies	<ul style="list-style-type: none"> ▪ Construct irrigation facilities ▪ Encourage and support the formation of farmer-based organisations ▪ Accelerate agricultural mechanisation ▪ Facilitate the supply of agriculture inputs ▪ Recruit agricultural extension services ▪ Introduce modern practices into agricultural production ▪ Support the fishing industry ▪ Facilitate the introduction of block farming ▪ Introduce improved varieties in agriculture ▪ Develop appropriate methodologies for post-harvest handling ▪ Organise training and sensitisation workshops for farmers regularly ▪ Facilitate micro finance and small-scale loans to farmers ▪ Intensify disease surveillance and control for livestock

Source: Greater Accra Region Coordinating Council

Table A1-11 POCC Analysis of MTDP of Asuogyaman District

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Inadequate arable lands	<ul style="list-style-type: none"> ▪ Availability of improved farming technologies, e.g., the application of fertiliser ▪ Presence of vast savannah lands for livestock farming 	<ul style="list-style-type: none"> ▪ GoG programme to promote selected crop development for food security, export and to support industry ▪ GoG's bid to promote Livestock and poultry development for food security and income 	<ul style="list-style-type: none"> ▪ Low income and poverty ▪ Weak revenue base ▪ Inadequate technical know-how in modern methods of farming 	<ul style="list-style-type: none"> ▪ High cost of inputs for modern methods of farming ▪ Uncoordinated training programmes for rural farmers
Conclusion: More farmers should be encouraged to undertake livestock farming on a large and productive scale. This would help reduce the pressure on the available arable land, and could be undertaken with the help of effective veterinary service provision. Moreover, with the application of fertiliser and other improved cultural practices, farmers can improve the output per acre of the limited arable lands available.				
Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Low agricultural productivity	<ul style="list-style-type: none"> ▪ The presence of Lake Volta for irrigation ▪ The presence of FBO in the district 	<ul style="list-style-type: none"> ▪ GoG support to develop appropriate irrigation schemes, dams, boreholes, and other water harvesting techniques for different categories of farmers and ecological zones 	<ul style="list-style-type: none"> ▪ Inadequate technical know-how in irrigation farming. ▪ Low income levels of rural farmers. 	<ul style="list-style-type: none"> ▪ Weak irrigation infrastructure
Conclusion: The presence of Lake Volta lake in the district and government support for subsistence food crop farmers through irrigation programmes will reduce the overreliance on rainfall for crop production.				
Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Poor road surface condition and network	<ul style="list-style-type: none"> ▪ Interest of DA and VRA in road and utility services development ▪ Support from DANIDA and NGOs 	<ul style="list-style-type: none"> ▪ Presence of ministry of roads and highways ▪ Presence of GHA 	<ul style="list-style-type: none"> ▪ Poor maintenance ▪ High cost of road construction and repairs 	<ul style="list-style-type: none"> ▪ Delays in the release of funding by the GoG and other donor agencies
Conclusion: The poor condition of the road surface and network can be addressed by harnessing the opportunities and potentials in the district. The constraints can be addressed by ensuring a proper maintenance culture. The challenges can be managed by ensuring the timely release of funds.				

Source: Eastern Region Coordinating Council

Table A1-12 Objectives of POCC of Asuogyaman District

Thematic Area	Agriculture Modernisation and Natural Resource Management
Issues	<ul style="list-style-type: none"> ▪ Low agricultural productivity
Objectives	<ul style="list-style-type: none"> ▪ To increase agriculture output on available arable land by 60% by the end of the planned period
Strategies	<ul style="list-style-type: none"> ▪ Introduce farmers to modern methods of farming ▪ Encourage farmers to go into productive livestock farming ▪ Provide farmers with micro finance support
Activities	<ul style="list-style-type: none"> ▪ Organize bi-annual training workshops for farmers on mechanised and productive methods of farming (e.g. application of fertilisers) ▪ Provide subsidised viable seeds, seedlings and other inputs to farmers ▪ Organise annual training workshops for livestock farmers ▪ Provide subsidised feeds and other inputs for large scale livestock farmers ▪ Construct cattle ponds ▪ Form FBOs to access credit facilities ▪ Conduct 162 field days for farmer beneficiaries in improved maize, cassava, plantain ▪ Carry out 51 demonstrations of crop production

Source: Eastern Region Coordinating Council

Table A1-13 POCC Analysis of MTDP of Lower Manya Krobo District

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Increased agricultural productivity	<ul style="list-style-type: none"> ▪ Adequate number of extension services ▪ Availability of agro-chemical shops ▪ The nearness to Accra making the district a good place for poultry and vegetable farming ▪ A double rainfall season ▪ Support by District Assembly ▪ Availability of Lake Volta for fishing and irrigation 	<ul style="list-style-type: none"> ▪ Readiness of financial institutions to give credit to farmer groups ▪ Various GoG credit schemes for farmers ▪ Support from NGOs and other international partners ▪ Availability of high yielding planting materials and disease resistant breeds of livestock. 	<ul style="list-style-type: none"> ▪ Inability & refusal of many farmers to repay loans ▪ Misappropriation of agro-chemicals ▪ Resistance to modern techniques by some farmers ▪ Low adaptability of farmers to innovation ▪ Over-reliance on rain-fed agriculture ▪ Inadequate storage facilities resulting in post-harvest losses ▪ Continuous use of local planting materials ▪ Low farmer-extension-officer ratio ▪ Use of unauthorised nets and chemicals for fishing 	<ul style="list-style-type: none"> ▪ Pest attacks ▪ Low prices for agricultural produce ▪ Flooding of the market with cheaper goods from abroad ▪ Politicisation of GoG interventions
Conclusion: Not available				
Improved layout of the towns in the district	<ul style="list-style-type: none"> ▪ Existence of Town and Country Planning Department ▪ Existence of Statutory Planning Committee ▪ Existence of by-laws 	<ul style="list-style-type: none"> ▪ Existence of national laws to ensure compliance by developers ▪ Integration of environmental department in local government ▪ Continuous capacity building of technical staff by MLG&RD 	<ul style="list-style-type: none"> ▪ Unfavourable land tenure system ▪ Undue pressure put on the Town and Country Planning Department ▪ Uncooperative attitude of land owners ▪ Financial constraints on the part of the District Assembly 	<ul style="list-style-type: none"> ▪ Shifting of the department of Town and Country Planning from one ministry to another ▪ Non-existence of environmental protection office at the district level
Conclusion: Not available				

Source: Eastern Region Coordinating Council

Table A1-14 Development Goals of PCCC of Lower Manya Krobo District

Thematic Area	Agriculture Modernisation and Natural Resource Management
Objectives	<ul style="list-style-type: none"> To enhance access to improved technologies and credit facilities to ensure food security and annual income
Strategies	<ul style="list-style-type: none"> Improve farmers' access to modern technology and financial resources for inputs. Reduce post-harvest crop losses Apply appropriate agricultural research and technology to introduce economies of scale in agricultural production Improve the effectiveness of Research-Extension farmer-Linkages Intensify the use of ICT and media to disseminate agricultural information to farmer Raise awareness about environmental issues Facilitate the training of out-grower farmers Improve and diversify livelihood opportunities for men and women in the post-harvest fishing sector
Objectives	<ul style="list-style-type: none"> To increase farmer competitiveness and enhance integration into domestic and international markets.
Strategies	<ul style="list-style-type: none"> Develop institutional capacity and sustainable programmes for non-export farmers
Objectives	<ul style="list-style-type: none"> To improve institutional Co-ordination and stakeholder engagement in agricultural activities in the district
Strategies	<ul style="list-style-type: none"> Develop and implement a communication strategy to improve supervision and inter-sectorial coordination. Raise farmer motivation
Objectives	<ul style="list-style-type: none"> To process and add value to agricultural produce
Strategies	<ul style="list-style-type: none"> Promote the establishment of agro-based industries to process agricultural produce
Thematic Area	Infrastructure, Energy, and Human Settlement Development
Objectives	<ul style="list-style-type: none"> To improve the general condition of 40% of the existing road network by December 2013
Strategies	<ul style="list-style-type: none"> Perform routine maintenance Construct and upgrade the road network
Objectives	<ul style="list-style-type: none"> To reduce vehicular congestion and traffic offences on the main Atua-Kpong road
Strategies	<ul style="list-style-type: none"> Enforce road traffic regulations Hold education campaign Improve the professionalism of the drivers

Source: Eastern Region Coordinating Council

Table A1-15 POCC Analysis of MTDP of Yilo Krobo District

Key Development Issues	Potentials	Opportunities	Constraints	Challenges
Poor development of tourism sector	<ul style="list-style-type: none"> Electricity Natural land marks Land Common Fund 	<ul style="list-style-type: none"> Tourists Private sector investment 	<ul style="list-style-type: none"> Land litigations Lack of access roads 	<ul style="list-style-type: none"> Similar potentials nearby
Conclusion:				
Poor development of the tourism sector can be addressed since significant potentials and opportunities exist. The constraints can be addressed through developing synergies in programme design. The challenge can be managed through effective marketing of the sites.				
Low production	<ul style="list-style-type: none"> Availability of land. Availability of labour and raw materials. MOFA Rains/rivers/streams/boreholes 	<ul style="list-style-type: none"> NGOs MCA MoFA 	<ul style="list-style-type: none"> Difficulty in acquiring land acquisition. High rent on land. High cost of labour. Land litigation. 	<ul style="list-style-type: none"> High interest rates Collateral High cost of inputs Irregular rainfall
Conclusion:				
Significant potentials and opportunities exist to address the issue of low production. The constraints can be dealt with through developing synergies in programme design. The challenges can be managed through dialogue with banks.				
Inadequate/poor market infrastructure.	<ul style="list-style-type: none"> DACF Land for extension. Market Associations Goods Technical support 	<ul style="list-style-type: none"> NGOs 	<ul style="list-style-type: none"> Difficulty in acquiring land. Inadequate documentation on land. Land litigation 	<ul style="list-style-type: none"> High cost of building markets.
Conclusion:				
Significant potentials and opportunities exist to help address the issue of inadequate/poor market infrastructure. The constraints can be addressed through developing synergies in programme design. The challenge can be managed through securing more funds.				
Inadequate/poor nature of roads	<ul style="list-style-type: none"> Gravels and chippings Availability of Common Fund Labour 	<ul style="list-style-type: none"> Road Fund NGOs DANIDA 	<ul style="list-style-type: none"> Rocky and hilly terrain Numerous streams 	<ul style="list-style-type: none"> High cost of construction/maintenance Delay in the release of funds
Conclusion:				
Significant potentials and opportunities exist to address the issue of inadequate/poor nature of roads. The constraints can be surmounted through developing synergies in programme design. The challenges can be managed through dialogue with Development Partners				

Source: Eastern Region Coordinating Council

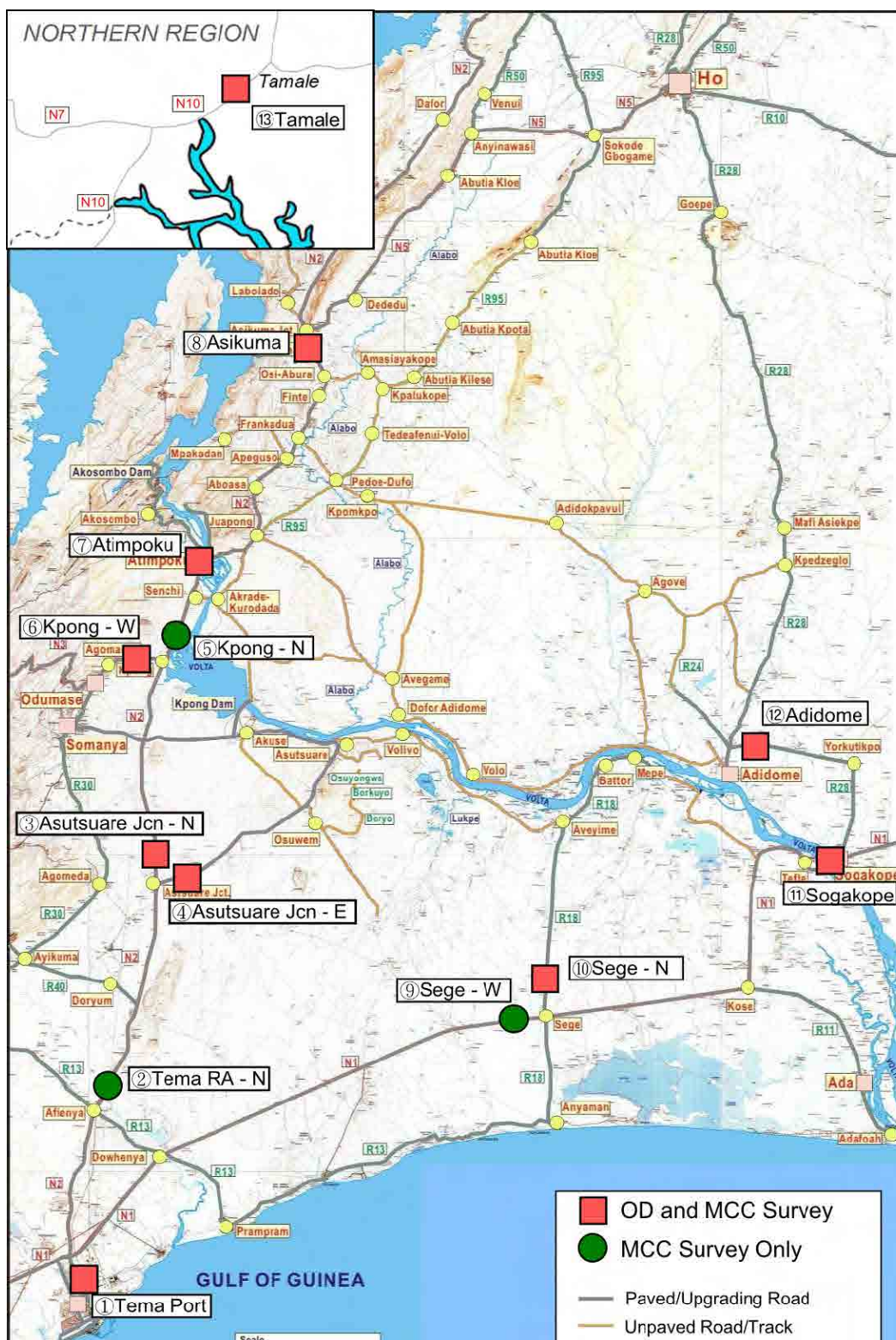
Table A1-16 Development Goals of POCC of Lower Yilo Krobo District

Thematic Area	Agriculture Modernisation and Natural Resource Management
Goals	<ul style="list-style-type: none"> ▪ To increase production and reduce post-harvest losses.
Objectives	<ul style="list-style-type: none"> ▪ To increase agricultural production in the district by 5% by 2013 ▪ To increase access to market for agricultural and industrial products ▪ To protect and conserve forest resources
Strategies	<ul style="list-style-type: none"> ▪ Construct 20 wells for irrigation ▪ Train farmers in the use of appropriate storage facilities, post-harvest handling and proper harvesting methods. ▪ Provide storage and small agro- processing facilities ▪ Provide incentives to extension service workers ▪ Facilitate the recruitment of extension workers ▪ Promote environmentally sustainable cropping practices ▪ Promote irrigated vegetable cultivation, cultivation of sugar cane and cassava, the rearing of grass-cutters and rabbits, beekeeping and fish farming. ▪ Control local animal diseases ▪ Conduct training in fish farming ▪ Provide credit facilities to farmers ▪ Encourage farmers to form co-operatives ▪ Disseminate market information to farmers ▪ Organise agricultural fairs ▪ Embark on reforestation exercises along Ponpon River upstream/forest reserves ▪ Improve market infrastructure in 5 communities
Thematic Area	Infrastructure, Energy and Human Settlements Development
Goals	<ul style="list-style-type: none"> ▪ To improve road infrastructure
Objectives	<ul style="list-style-type: none"> ▪ To enhance accessibility (road) in the District
Strategies	<ul style="list-style-type: none"> ▪ Provide electricity to 30 communities ▪ Construct and maintain 200km of feeder roads ▪ Extend telecommunication/internet services to 20 communities ▪ Enforce building regulations ▪ Create land banks. ▪ Conduct educational campaigns on safe sanitation practices ▪ Promote and support the construction of 100 household toilets ▪ Construct 3 public toilets and 20 institutional latrines ▪ Convert 4 public pan latrines into cesspit tank latrines in collaboration with the private sector ▪ Provide and place 70 refuse containers at designated points ▪ Embark on house-to-house refuse collection at selected areas in Somanya ▪ Enact sanitation by-laws to ensure proper management of household-level liquid waste ▪ Enforce laws on the provision of sanitation facilities and other infrastructure by developers ▪ Construct 50 boreholes ▪ Rehabilitate 30 hand-dug wells ▪ Rehabilitate the Somanya pipe system ▪ Coordinate the activities of all water providers in the district ▪ Encourage communities to participate in the provision and maintenance of potable water facilities

Source: Eastern Region Coordinating Council

Appendix 2 Results of Cross Sectional Traffic Volume Counting Survey

Appendix 2-1 Location of MCC Stations



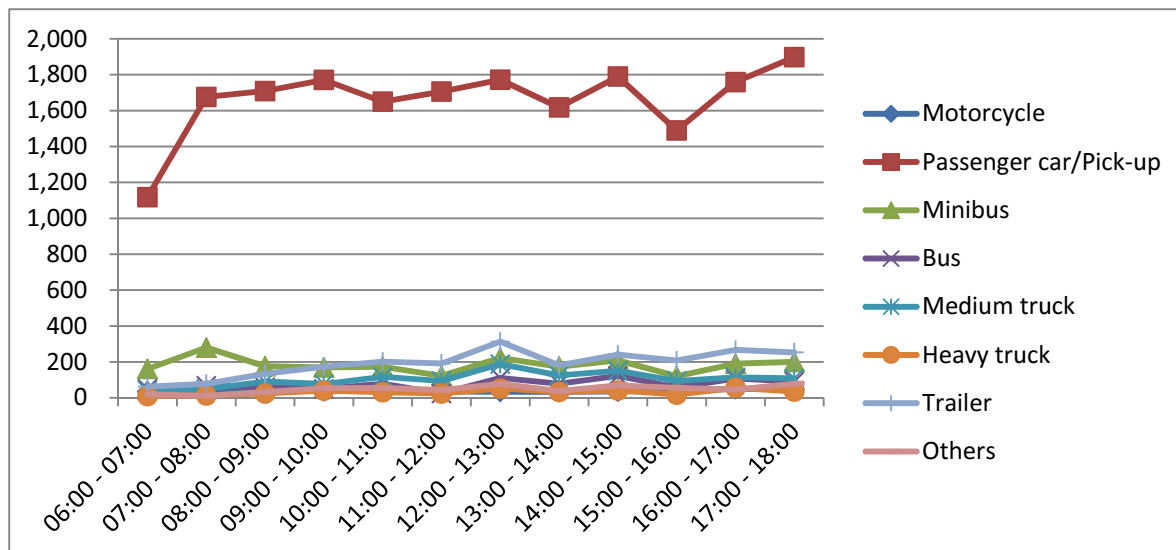
Appendix 2-2 Results of MCC at Station No. 1

Station Number : 1
 Station Name : Tema Port
 Road : Harbour Road
 Day-Night Ratio : 1.528
 Weekly Fluctuation : 0.8
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 15.1%

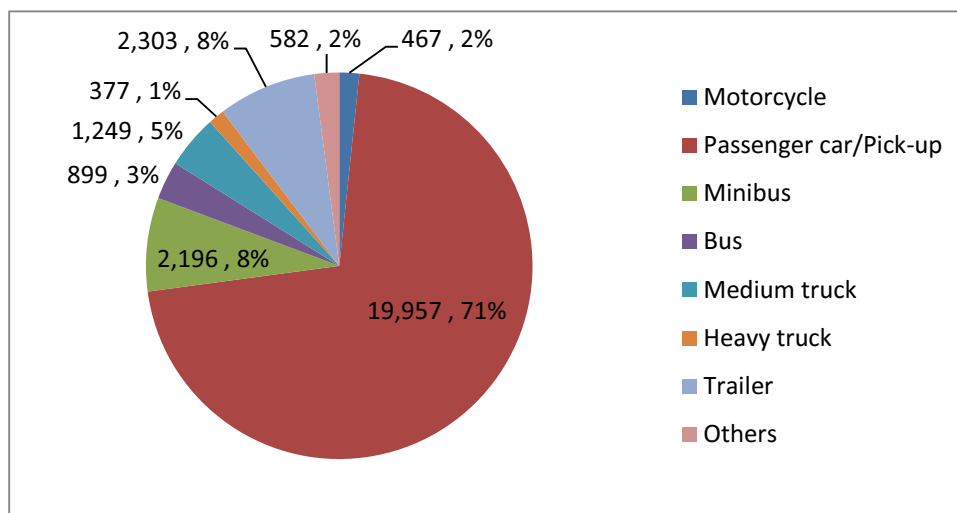
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	1,118	1,676	1,709	1,771	1,650	1,706	1,772	1,618	1,790	1,490	1,759	1,898	19,957	30,494	31,765
2	Minibus	161	280	176	169	173	122	222	173	209	121	190	200	2,196	3,355	3,495
3	Bus	51	68	59	50	79	24	111	79	122	58	107	91	899	1,374	1,431
4	Medium truck	41	50	90	77	117	94	188	125	151	94	114	108	1,249	1,908	1,988
5	Heavy truck	10	13	24	40	31	24	52	33	41	18	56	35	377	576	600
6	Trailer	62	78	134	173	202	191	313	181	241	208	267	253	2,303	3,519	3,666
7	Others	19	11	33	54	55	43	78	39	70	55	46	79	582	889	926
TOTAL		1,462	2,176	2,225	2,334	2,307	2,204	2,736	2,248	2,624	2,044	2,539	2,664	27,563	42,115	43,870

Hourly Fluctuation



Vehicle Composition



Station Number	:	2
Station	:	Tema Roundabout North
Road	:	N2
Day-Night Ratio	:	1.446
Weekly Fluctuation	:	0.8
Monthly Fluctuation	:	1.2
Commercial Vehicle Ratio	:	5.4%

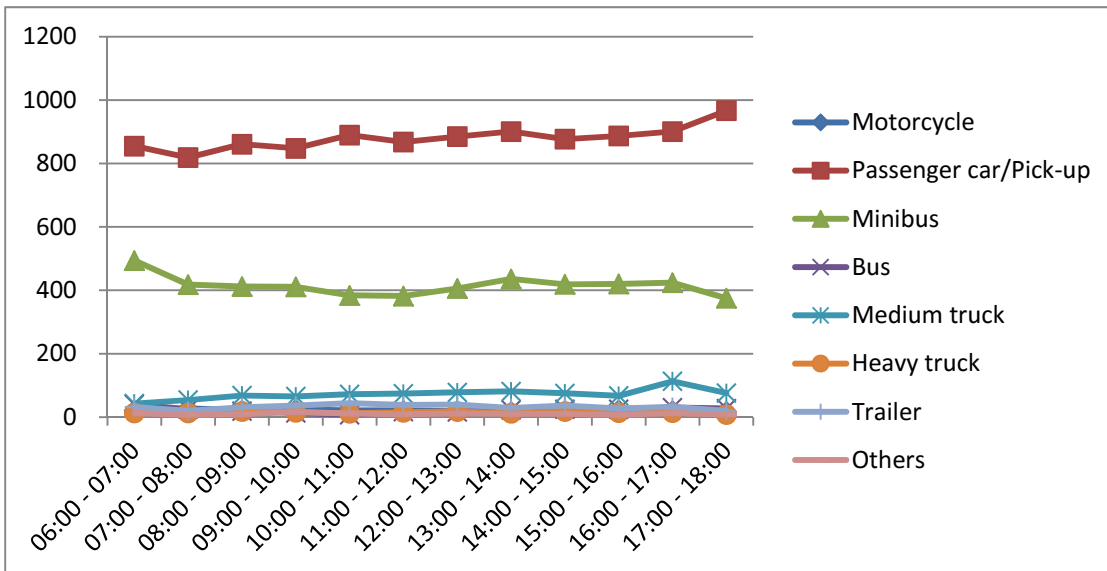
Appendix 2-3 Results of MCC at Station No. 2

Station Number : 2
 Station : Tema Roundabout North
 Road : N2
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 0.8
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 5.4%

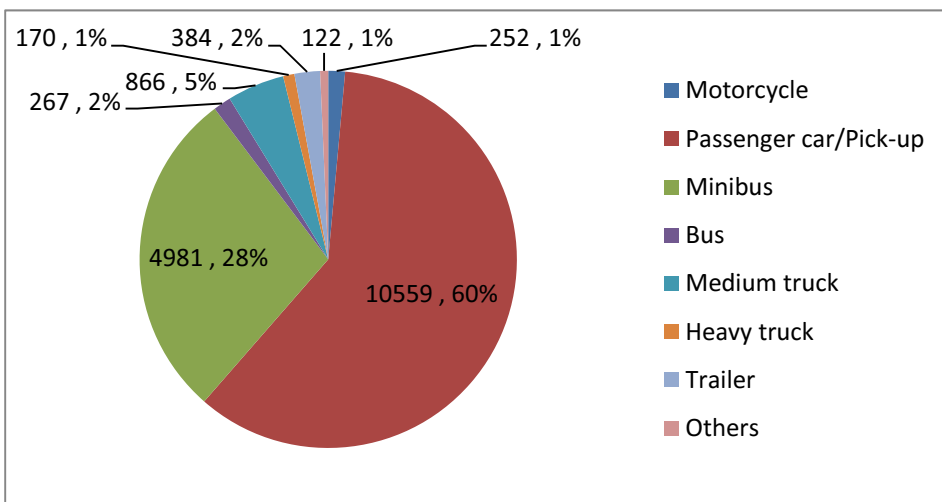
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	855	819	861	848	890	868	885	901	877	887	901	967	10,559	15,268	15,904
2	Minibus	494	418	412	411	384	382	406	436	419	420	424	375	4,981	7,203	7,503
3	Bus	40	25	19	13	7	17	16	23	25	25	30	27	267	386	402
4	Medium truck	43	54	68	65	72	74	78	81	75	67	113	76	866	1,252	1,304
5	Heavy truck	13	13	18	15	12	15	18	12	18	14	14	8	170	246	256
6	Trailer	32	20	31	36	44	38	39	29	36	27	32	20	384	555	578
7	Others	12	7	9	16	11	9	11	10	10	7	12	8	122	176	183
TOTAL		1,489	1,356	1,418	1,404	1,420	1,403	1,453	1,492	1,460	1,447	1,526	1,481	17,349	25,086	26,131

Hourly Fluctuation



Vehicle Composition



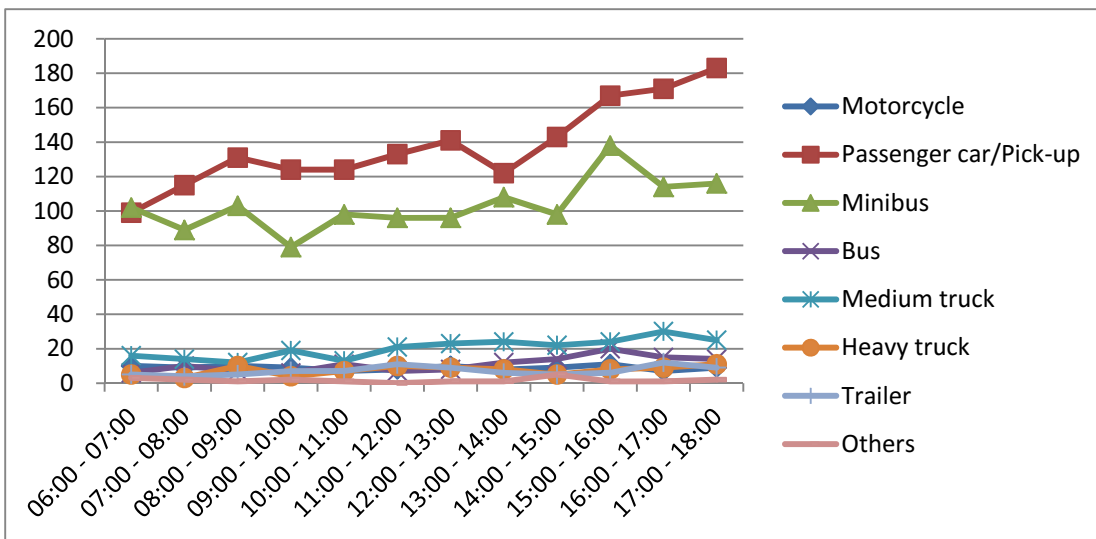
Appendix 2-4 Results of MCC at Station No. 3

Station Number : 3
 Station : Asutsuare Jct. North
 Road : N2
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 1.05
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 9.4%

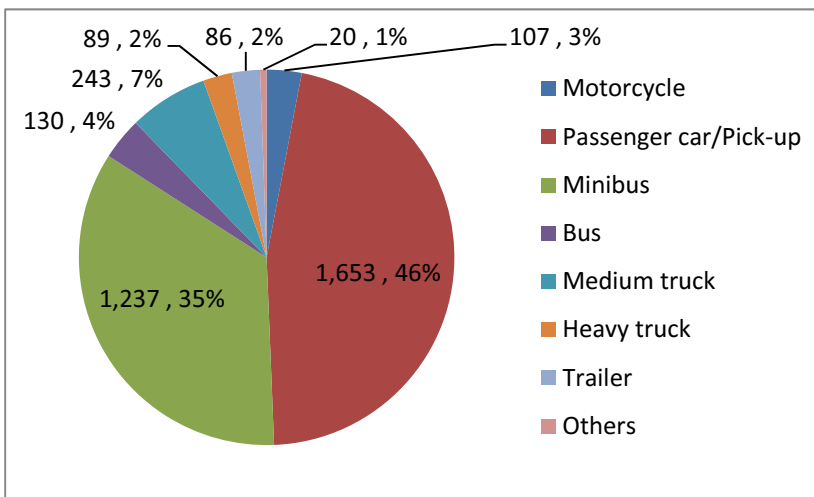
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	99	115	131	124	124	133	141	122	143	167	171	183	1,653	2,390	1,897
2	Minibus	102	89	103	79	98	96	96	108	98	138	114	116	1,237	1,789	1,420
3	Bus	6	10	7	6	11	7	8	12	14	20	15	14	130	188	149
4	Medium truck	16	14	12	19	13	21	23	24	22	24	30	25	243	351	279
5	Heavy truck	5	3	10	4	7	10	9	8	5	8	9	11	89	129	102
6	Trailer	5	4	5	7	7	11	9	6	5	6	12	9	86	124	98
7	Others	3	2	1	2	1	0	1	1	5	1	1	2	20	29	23
	TOTAL	236	237	269	241	261	278	287	281	292	364	352	360	3,458	5,000	3,968

Hourly Fluctuation



Vehicle Composition



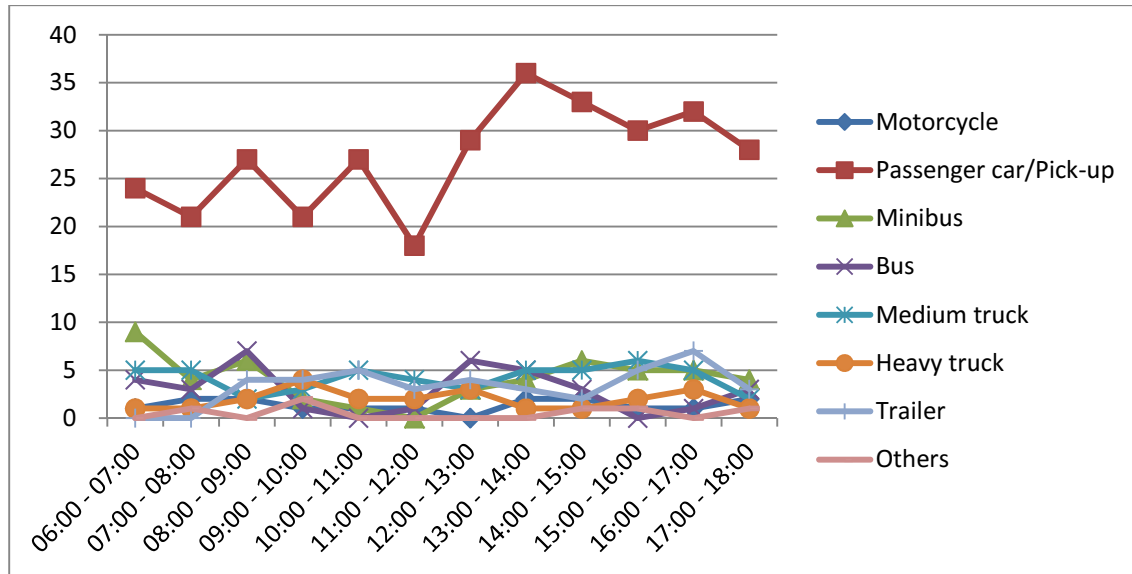
Appendix 2-5 Results of MCC at Station No. 4

Station Number : 4
 Station : Asutsuare Jct. East
 Road : Asutsuare Jct. – Asutsuare
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 1.05
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 19.5%

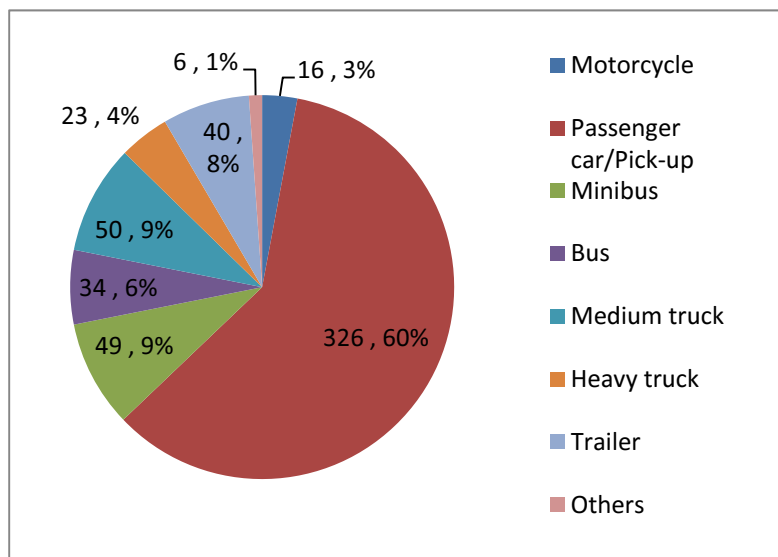
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	24	21	27	21	27	18	29	36	33	30	32	28	326	471	374
2	Minibus	9	4	6	2	1	0	3	4	6	5	5	4	49	71	56
3	Bus	4	3	7	1	0	1	6	5	3	0	1	3	34	49	39
4	Medium truck	5	5	2	3	5	4	3	5	5	6	5	2	50	72	57
5	Heavy truck	1	1	2	4	2	2	3	1	1	2	3	1	23	33	26
6	Trailer	0	0	4	4	5	3	4	3	2	5	7	3	40	58	46
7	Others	0	1	0	2	0	0	0	0	1	1	0	1	6	9	7
	TOTAL	43	35	48	37	40	28	48	54	51	49	53	42	528	763	606

Hourly Fluctuation



Vehicle Composition



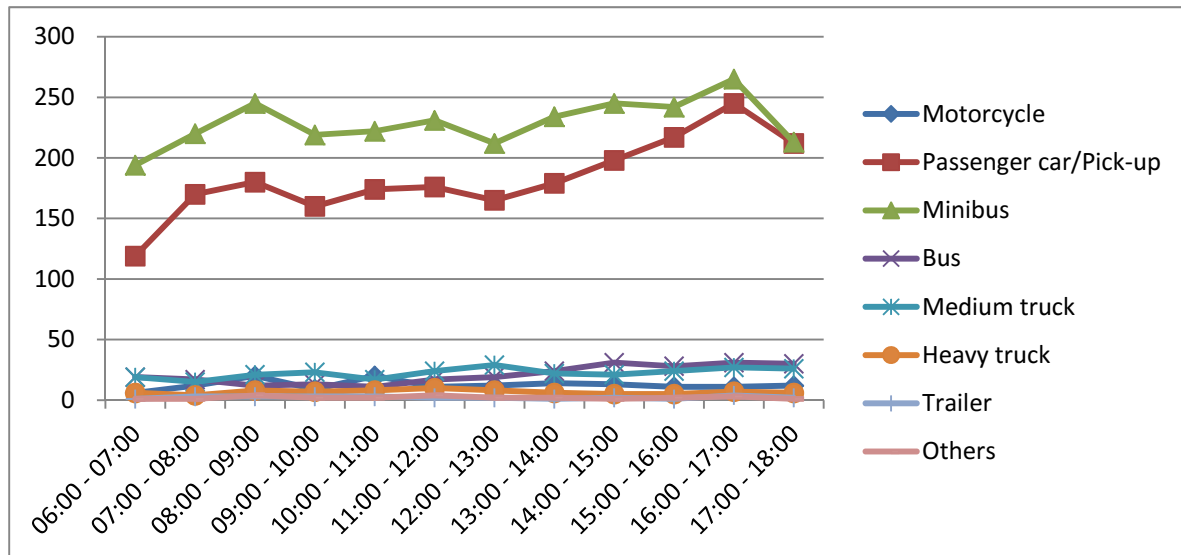
Appendix 2-6 Results of MCC at Station No. 5

Station Number : 5
 Station : Kpong North
 Road : N2
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 1.05
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 6.9%

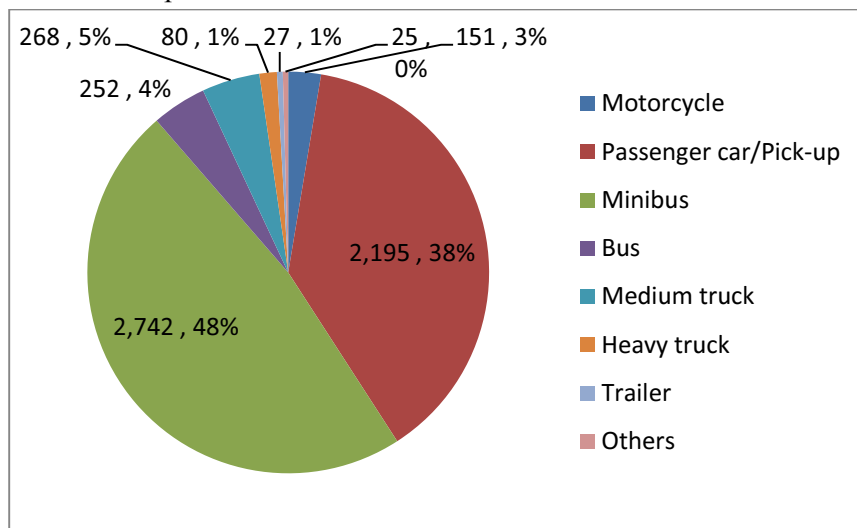
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	119	170	180	160	174	176	165	179	198	217	245	212	2,195	3,174	2,519
2	Minibus	194	220	245	219	222	231	212	234	245	242	265	213	2,742	3,965	3,147
3	Bus	19	17	12	13	11	17	19	24	31	28	31	30	252	364	289
4	Medium truck	19	15	21	23	17	24	29	22	21	24	27	26	268	388	308
5	Heavy truck	6	4	8	7	8	10	8	6	5	5	7	6	80	116	92
6	Trailer	1	3	3	3	3	2	2	1	2	1	4	2	27	39	31
7	Others	1	1	4	2	2	4	2	2	1	2	3	1	25	36	29
TOTAL		359	430	473	427	437	464	437	468	503	519	582	490	5,589	8,082	6,414

Hourly Fluctuation



Vehicle Composition



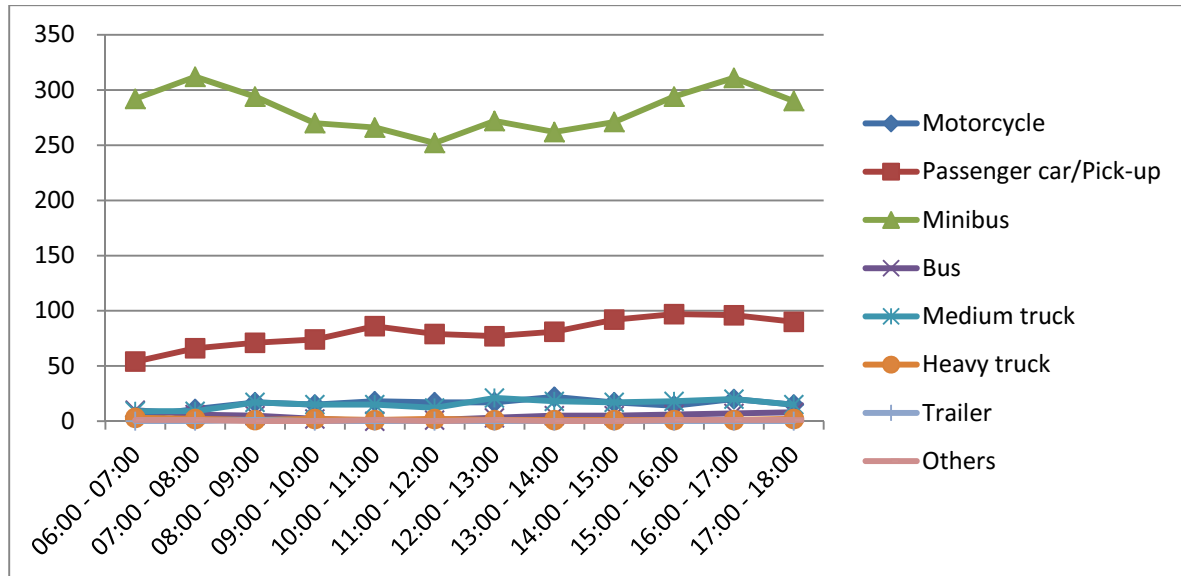
Appendix 2-7 Results of MCC at Station No. 6

Station Number : 6
 Station : Kpong West
 Road : N3
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 1.05
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 1.8%

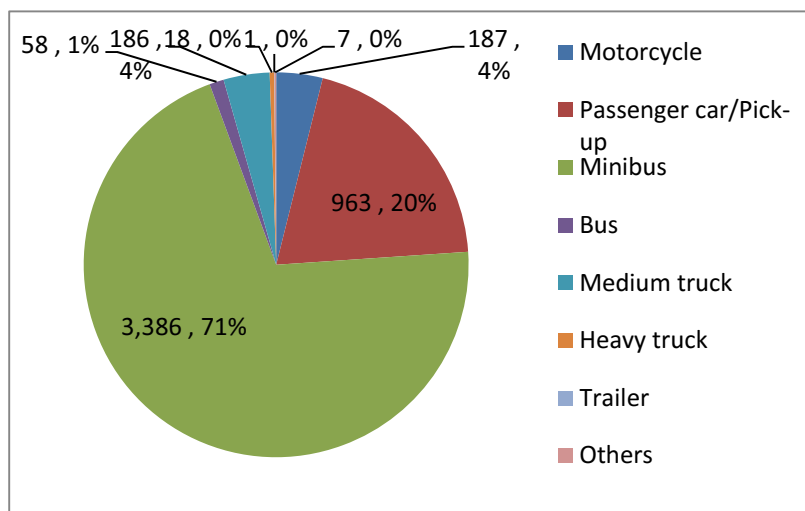
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	54	66	71	74	86	79	77	81	92	97	96	90	963	1,392	1,105
2	Minibus	292	312	294	270	266	252	272	262	271	294	311	290	3,386	4,896	3,886
3	Bus	10	6	5	2	0	1	3	5	5	6	7	8	58	84	67
4	Medium truck	9	9	17	15	15	12	21	18	17	18	20	15	186	269	213
5	Heavy truck	3	2	1	2	1	2	1	1	1	1	1	2	18	26	21
6	Trailer	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1
7	Others	1	1	0	0	1	0	1	0	0	1	1	1	7	10	8
	TOTAL	369	396	389	363	369	346	375	367	386	417	436	406	4,619	6,678	5,300

Hourly Fluctuation



Vehicle Composition



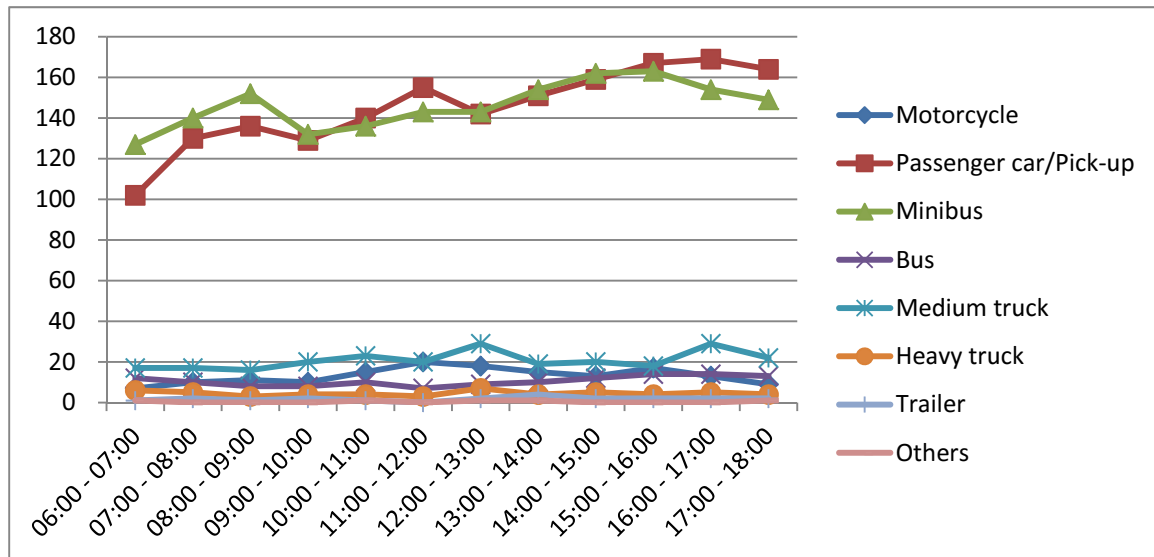
Appendix 2-8 Results of MCC at Station No. 7

Station Number : 7
 Station : Atimpoku
 Road : N2
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 1.05
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 5.2%

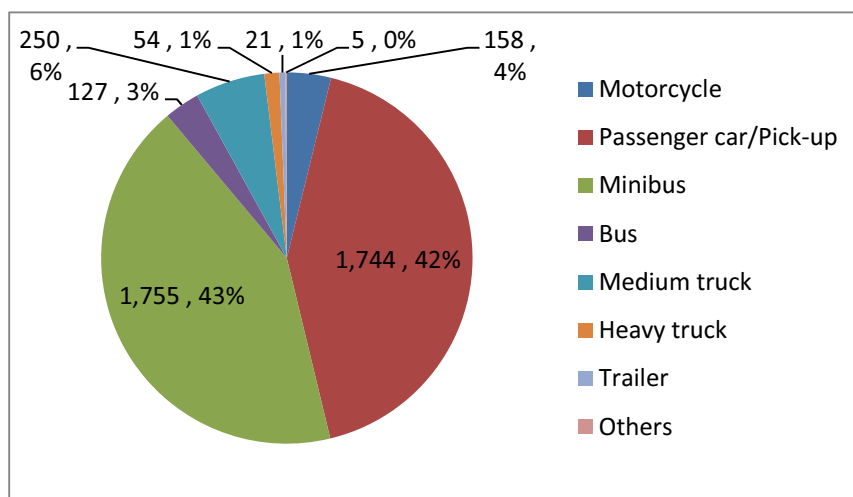
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	102	130	136	129	140	155	142	151	159	167	169	164	1,744	2,522	2,002
2	Minibus	127	140	152	132	136	143	143	154	162	163	154	149	1,755	2,538	2,014
3	Bus	12	10	8	8	10	7	9	10	12	14	14	13	127	184	146
4	Medium truck	17	17	16	20	23	20	29	19	20	18	29	22	250	362	287
5	Heavy truck	6	5	3	4	4	3	7	4	5	4	5	4	54	78	62
6	Trailer	1	2	1	2	1	0	2	4	2	2	2	2	21	30	24
7	Others	1	0	0	0	1	0	1	1	0	0	0	1	5	7	6
	TOTAL	266	304	316	295	315	328	333	343	360	368	373	355	3,956	5,721	4,540

Hourly Fluctuation



Vehicle Composition



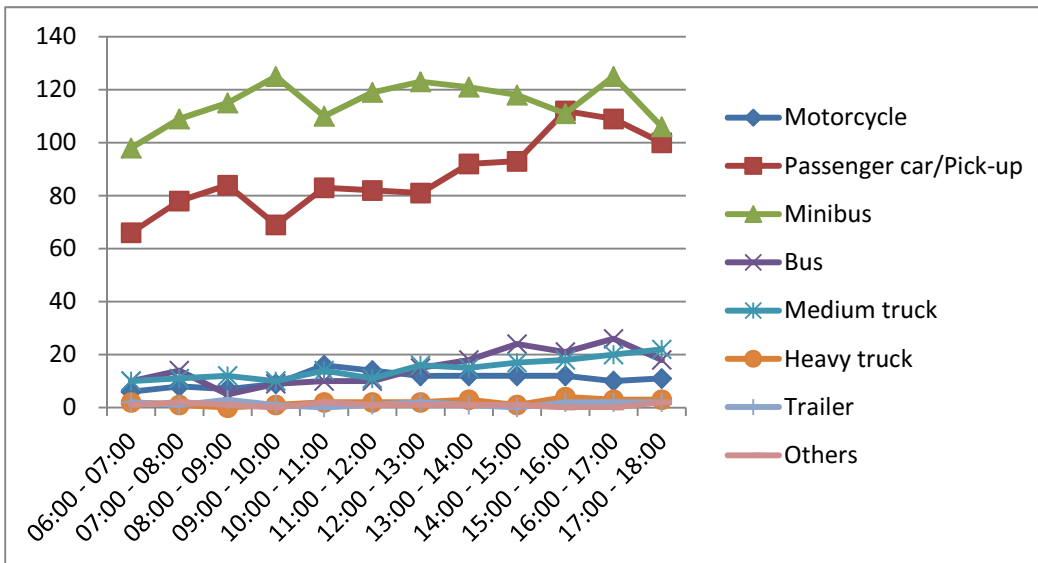
Appendix 2-9 Results of MCC at Station No. 8

Station Number : 8
 Station : Asikuma
 Road : N2
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 1.05
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 8.2%

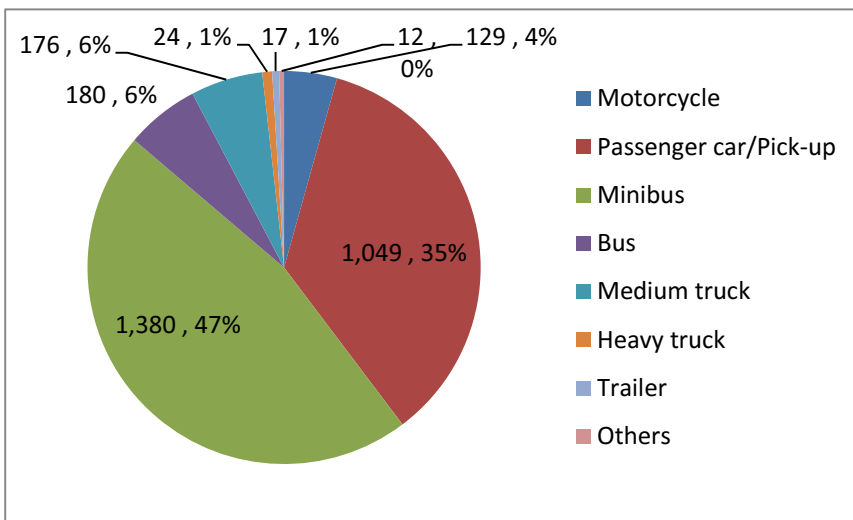
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	66	78	84	69	83	82	81	92	93	112	109	100	1,049	1,517	1,204
2	Minibus	98	109	115	125	110	119	123	121	118	111	125	106	1,380	1,995	1,583
3	Bus	10	14	5	9	10	10	15	18	24	21	26	18	180	260	206
4	Medium truck	10	11	12	10	14	11	16	15	17	18	20	22	176	254	202
5	Heavy truck	2	1	0	1	2	2	2	3	1	4	3	3	24	35	28
6	Trailer	2	1	3	1	0	1	2	1	0	2	2	2	17	25	20
7	Others	1	2	1	0	2	1	1	1	1	0	0	2	12	17	13
TOTAL		189	216	220	215	221	226	240	251	254	268	285	253	2,838	4,103	3,256

Hourly Fluctuation



Vehicle Composition



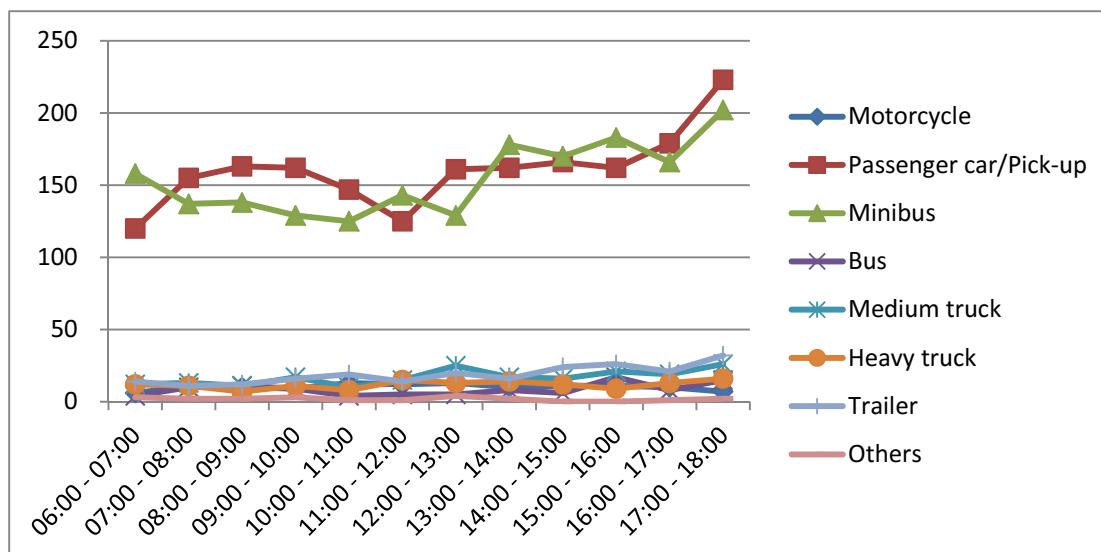
Appendix 2-10 Results of MCC at Station No. 9

Station Number : 9
 Station : Sege West
 Road : NI
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 0.8
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 10.9%

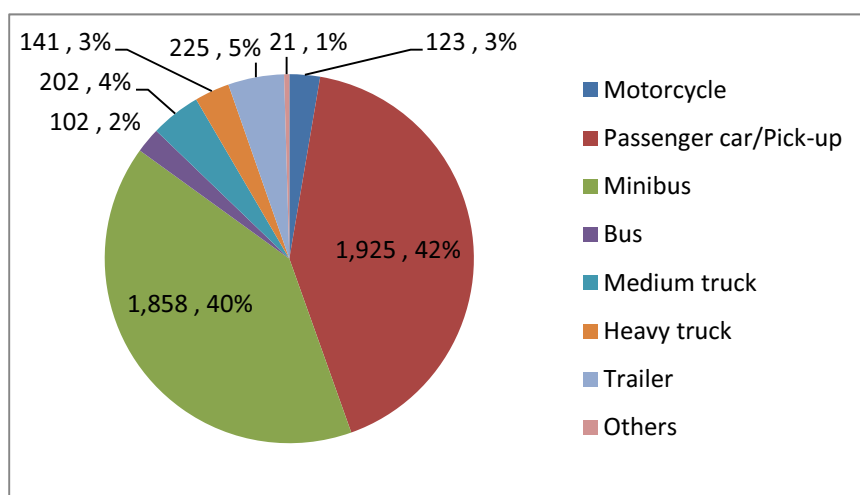
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	120	155	163	162	147	125	161	162	166	162	179	223	1,925	2,784	2,900
2	Minibus	158	137	138	129	125	143	129	178	170	183	166	202	1,858	2,687	2,799
3	Bus	4	10	11	9	4	5	5	8	6	17	8	15	102	147	153
4	Medium truck	12	13	11	17	10	15	25	17	16	21	19	26	202	292	304
5	Heavy truck	12	11	7	11	8	15	13	14	12	9	13	16	141	204	213
6	Trailer	14	11	12	16	19	14	20	16	24	26	21	32	225	325	339
7	Others	3	2	2	3	1	1	4	2	0	0	1	2	21	30	31
	TOTAL	323	339	344	347	314	318	357	397	394	418	407	516	4,474	6,469	6,739

Hourly Fluctuation



Vehicle Composition



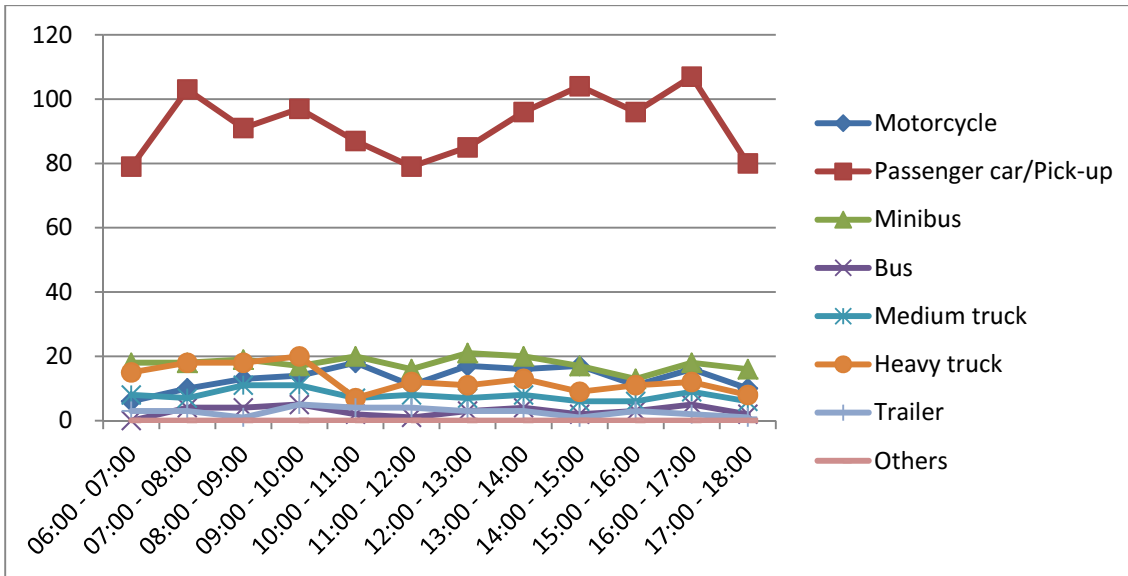
Appendix 2-11 Results of MCC at Station No. 10

Station Number : 10
 Station : Sege North
 Road : R18
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 0.8
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 13.6%

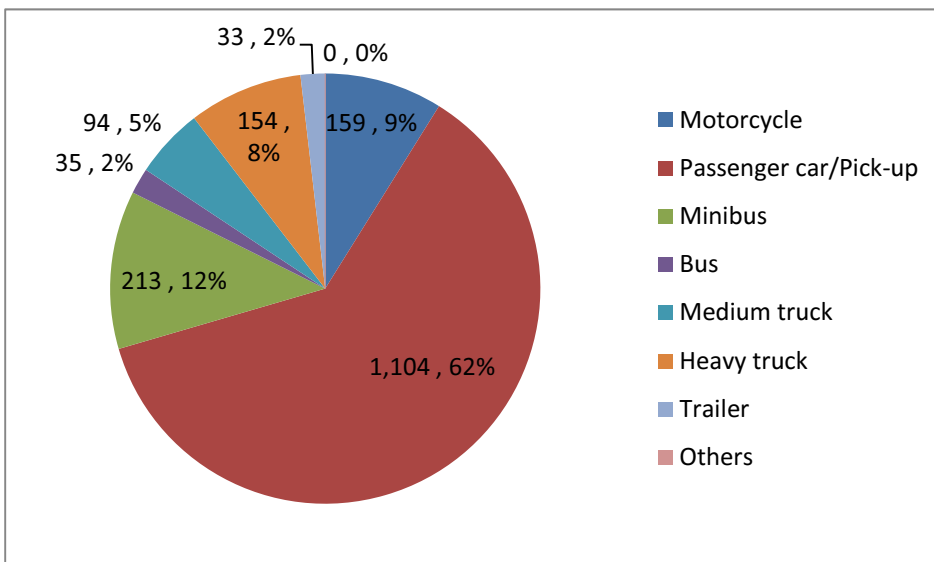
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	79	103	91	97	87	79	85	96	104	96	107	80	1,104	1,596	1,663
2	Minibus	18	18	19	17	20	16	21	20	17	13	18	16	213	308	321
3	Bus	0	4	4	5	2	1	3	4	2	3	5	2	35	51	53
4	Medium truck	8	7	11	11	7	8	7	8	6	6	9	6	94	136	142
5	Heavy truck	15	18	18	20	7	12	11	13	9	11	12	8	154	223	232
6	Trailer	3	3	1	5	4	4	3	3	1	3	2	1	33	48	50
7	Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	123	153	144	155	127	120	130	144	139	132	153	113	1,633	2,362	2,460

Hourly Fluctuation



Vehicle Composition



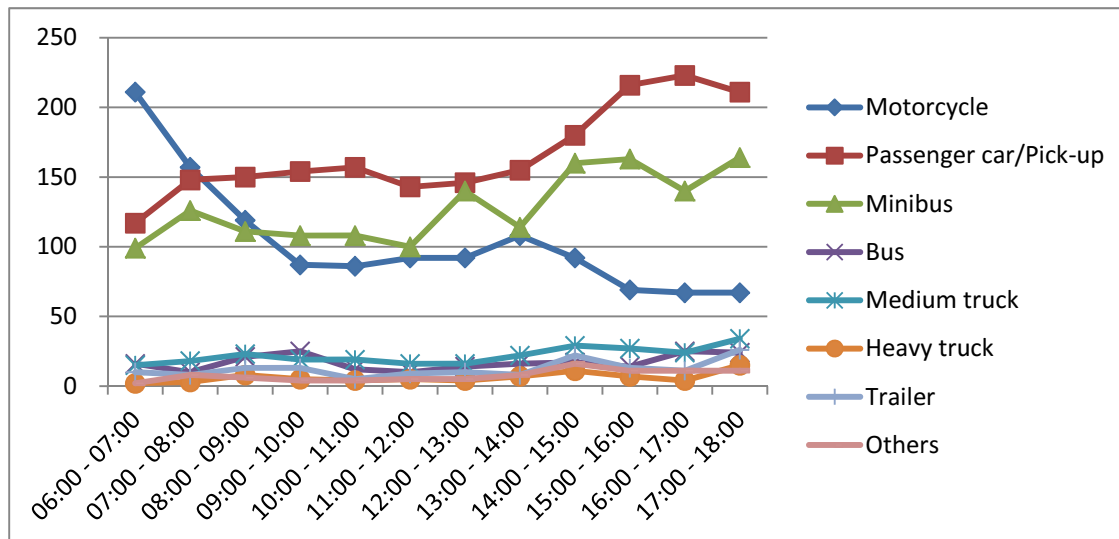
Appendix 2-12 Results of MCC at Station No. 11

Station Number : 11
 Station : Sogakope
 Road : NI
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 0.8
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 12.0%

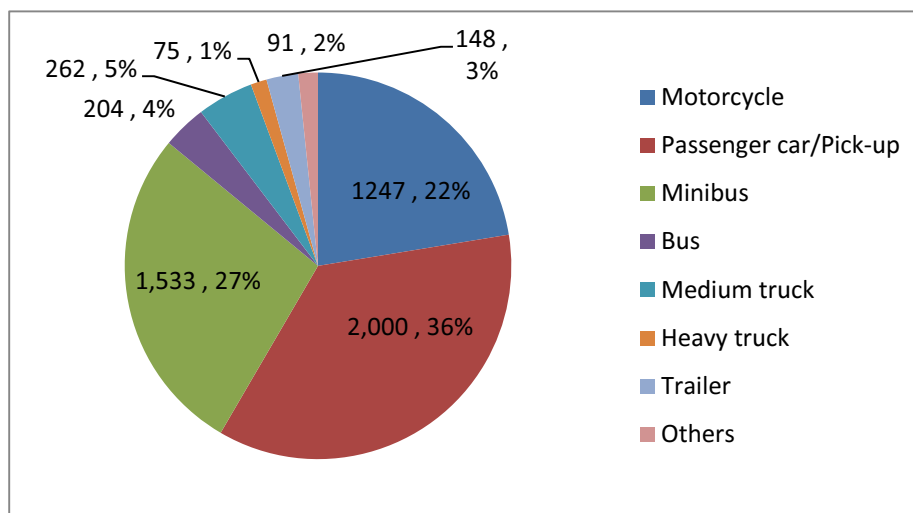
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	117	148	150	154	157	143	146	155	180	216	223	211	2,000	2,892	3,013
2	Minibus	99	126	111	108	108	100	140	114	160	163	140	164	1,533	2,217	2,309
3	Bus	16	10	21	25	12	10	14	16	17	14	25	24	204	295	307
4	Medium truck	15	18	23	19	19	16	16	22	29	27	24	34	262	379	395
5	Heavy truck	2	3	8	5	4	5	4	7	11	7	4	15	75	108	113
6	Trailer	10	8	13	13	5	9	10	8	22	13	11	26	148	214	223
7	Others	2	8	6	4	4	5	5	8	16	11	11	11	91	132	138
	TOTAL	261	321	332	328	309	288	335	330	435	451	438	485	4,313	6,237	6,497

Hourly Fluctuation



Vehicle Composition



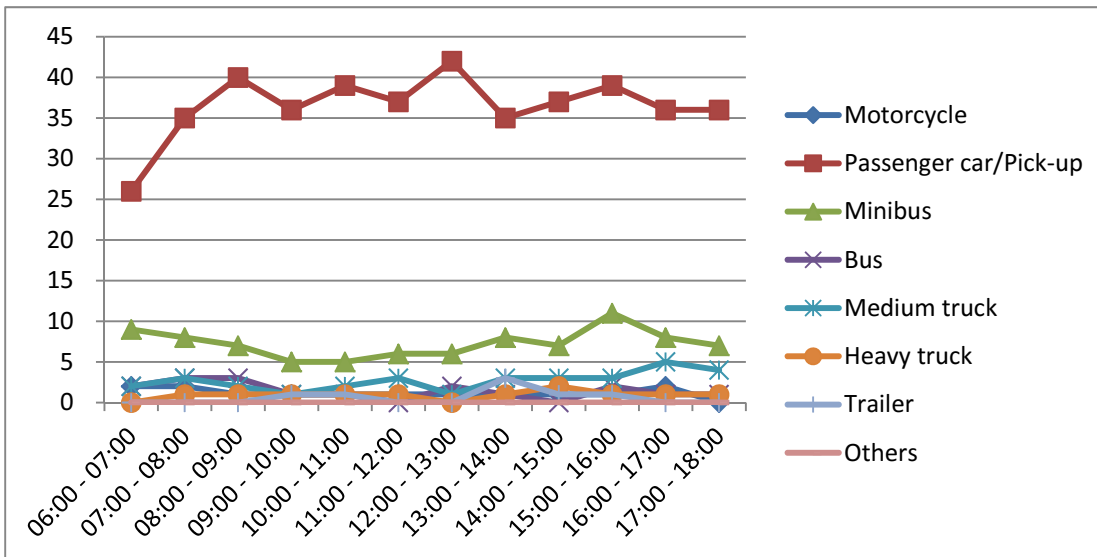
Appendix 2-13 Results of MCC at Station No. 12

Station Number : 12
 Station : Adidome
 Road : R28
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 0.8
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 5.9%

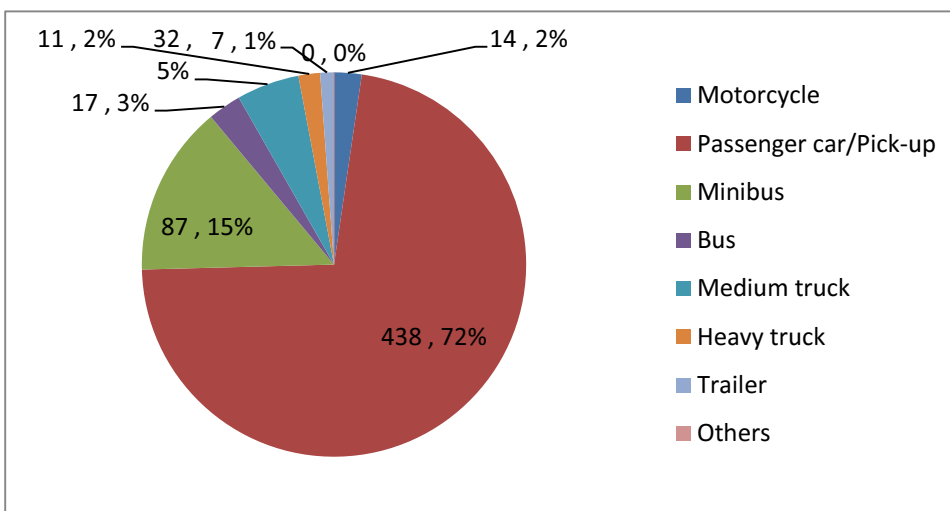
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	26	35	40	36	39	37	42	35	37	39	36	36	438	633	659
2	Minibus	9	8	7	5	5	6	6	8	7	11	8	7	87	126	131
3	Bus	2	3	3	1	1	0	2	1	0	2	1	1	17	25	26
4	Medium truck	2	3	2	1	2	3	1	3	3	3	5	4	32	46	48
5	Heavy truck	0	1	1	1	1	1	0	1	2	1	1	1	11	16	17
6	Trailer	0	0	0	1	1	0	0	3	1	1	0	0	7	10	10
7	Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		39	50	53	45	49	47	51	51	50	57	51	49	592	856	892

Hourly Fluctuation



Vehicle Composition



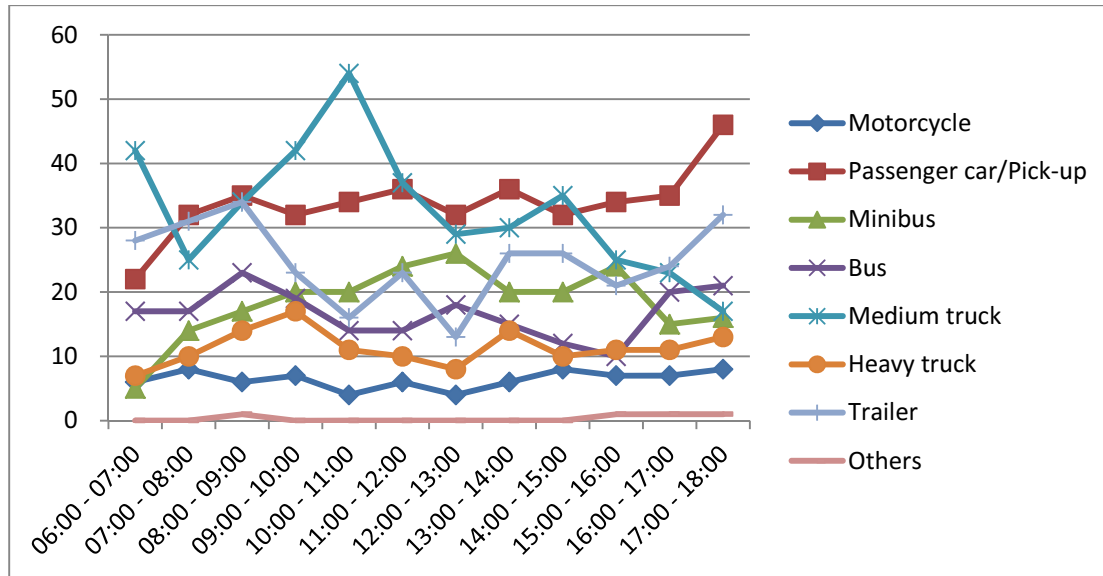
Appendix 2-14 Results of MCC at Station No. 13

Station Number : 13
 Station : Tamale
 Road : N10 (Central Corridor)
 Day-Night Ratio : 1.446
 Weekly Fluctuation : 1.05
 Monthly Fluctuation : 1.2
 Commercial Vehicle Ratio : 38.4%

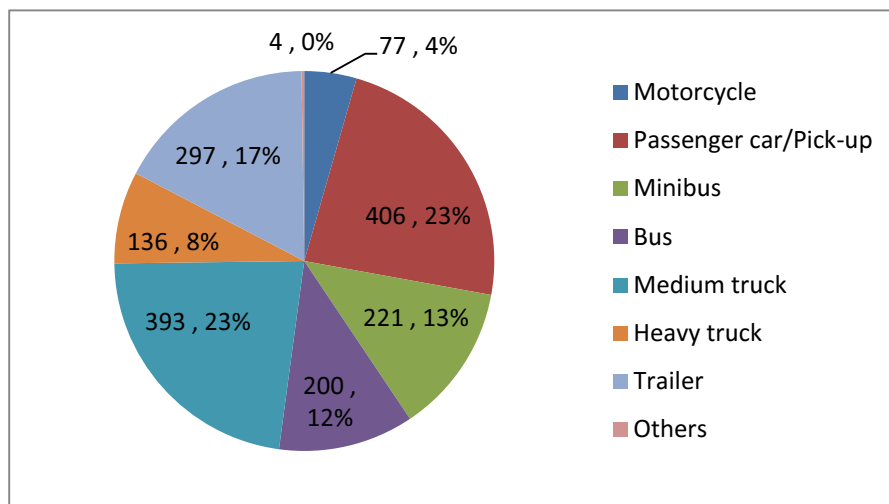
Observed Traffic and ADT

No.	VEHICLE TYPE	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	TOTAL	24-hour Volume	ADT
1	Passenger car	22	32	35	32	34	36	32	36	32	34	35	46	406	587	466
2	Minibus	5	14	17	20	20	24	26	20	20	24	15	16	221	320	254
3	Bus	17	17	23	19	14	14	18	15	12	10	20	21	200	289	229
4	Medium truck	42	25	34	42	54	37	29	30	35	25	23	17	393	568	451
5	Heavy truck	7	10	14	17	11	10	8	14	10	11	11	13	136	197	156
6	Trailer	28	31	34	23	16	23	13	26	26	21	24	32	297	429	340
7	Others	0	0	1	0	0	0	0	0	0	1	1	1	4	6	5
	TOTAL	121	129	158	153	149	144	126	141	135	126	129	146	1,657	2,396	1,902

Hourly Fluctuation



Vehicle Composition



Appendix 4 Link Data of Road Network for Traffic Demand Forecast

Table A4-1 Link Data of Road Network for Traffic Demand Forecast (1)

No.	Corridor	Code	Node Name		Node No.		Distance (km)	Surface	Class	No. of Lane	Condition	Width (m)
			From	To	From	To						
1	Eastern	N2P-1	Tema Port	Tema Roundabout	27	73	6.2	Paved	National	2	Good	7.3
2	Eastern	N2P-2	Tema Roundabout	Afienea	73	72	13	Paved	National	2	Good	7.3
3	Eastern	N2P-3	Afienea	Doryum	72	71	10.2	Paved	National	2	Fair	7.3
4	Eastern	N2P-4	Doryum	Asutsuare Jct.	71	59	10.6	Paved	National	2	Fair	7.3
5	Eastern	N2P-5	Asutsuare Jct.	Akuse Jct.	59	67	12.9	Paved	National	2	Fair	7.5
6	Eastern	N2P-6	Akuse Jct.	Kpong	67	66	7.3	Paved	National	2	Fair	7.5
7	Eastern	N2P-7	Kpong	Atimpoku	66	7	10.0	Paved	National	2	Fair	7.5
8	Eastern	N2P-8	Atimpoku	Adome	7	52	4.2	Paved	National	2	Fair	7.5
9	Eastern	N2P-9	Adome	Juapong	52	53	1.5	Paved	National	2	Fair	7.5
10	Eastern	N2P-10	Juapong	Frankadua	53	54	10.3	Paved	National	2	Fair	7.4
11	Eastern	N2P-11	Frankadua	Osi-Abura	54	55	5.6	Paved	National	2	Fair	7.2
12	Eastern	N2P-12	Osi-Abura	Asikuma Jct.	55	8	4.9	Paved	National	2	Fair	7.2
13	Eastern	N2P-13	Asikuma Jct.	Dafor	8	20	23.0	Paved	National	2	Good	7.3
14	Eastern	N2P-14	Dafor	Fume	20	19	32.2	Paved	National	2	Good	7.3
15	Coastal	N1P-1	Aflao	Akatsi	41	26	51.6	Paved	National	2	Fair	7.8
16	Coastal	N1P-2	Akatsi	Sogakope	26	16	29.3	Paved	National	2	Fair	7.8
17	Coastal	N1P-3	Sogakope	Peterkope	16	65	8.4	Paved	National	2	Good	7.9
18	Coastal	N1P-4	Peterkope	Kase	65	18	11.2	Paved	National	2	Good	7.6
19	Coastal	N1P-5	Kase	Sege	18	62	17.9	Paved	National	2	Good	7.6
20	Coastal	N1P-6	Sege	Nyigbenya	62	17	19.0	Paved	National	2	Good	7.6
21	Coastal	N1P-7	Dawhenya	Dawhenya	17	61	28.9	Paved	National	2	Good	7.6
22	Coastal	N1P-8	Dawhenya	Tema Roundabout	61	73	12.4	Paved	National	2	Good	7.6
23	-	R28P-1	Sogakope	Adidome	16	6	20.3	Paved	Regional	2	Good	7.3
24	-	R28P-2	Adidome	Dadaboe	6	51	5.1	Paved	Regional	2	Good	7.3
25	-	R28P-3	Dadaboe	Kpedzeglo	51	49	12.1	Paved	Regional	2	Good	7.3
26	-	R28P-4	Kpedzeglo	Mafi Asiekpe	49	5	3.2	Paved	Regional	2	Good	7.3
27	-	R28G-5	Mafi Asiekpe	Tsrefe	5	12	29.4	Gravel	Regional	2	Good	7.3
28	-	R28G-6	Tsrefe	Ho	12	11	13.3	Gravel	Regional	2	Good	7.3
29	-	R28G-7	Ho	Fume	11	19	24.8	Gravel	Regional	2	Good	7.3
30	-	N5P-1	Asikuma	Dededu	8	9	5.7	Paved	National	2	Good	7.2
31	-	N5P-2	Dededu	Anyinawasi	9	10	17.9	Paved	National	2	Good	7.2
32	-	N5P-3	Anyinawasi	Sokode Gbogame	10	58	10.9	Paved	National	2	Fair	7.2
33	-	N5P-4	Sokode Gbogame	Ho	58	11	9.4	Paved	National	2	Fair	7.2
34	-	N3P-1	Kpong	Odumase	66	22	7.0	Paved	National	2	Fair	6.6
35	-	R21P-1	Atimpoku	Akosombo	7	21	14.2	Paved	Regional	2	Fair	7.1
36	-	R95G-1	Juapong	Padoe Dufo	53	45	8.3	Gravel	Regional	2	Fair	5.7
37	-	R95G-2	Padoe Dufo	Kpolukope	45	56	8.5	Gravel	Regional	2	Fair	5.7
38	-	R95G-3	Kpolukope	Abutia Kloe	56	57	19.8	Gravel	Regional	2	Fair	5.7
39	-	R95P-4	Abutia Kloe	Sokode Gbogame	57	58	11.8	Paved	Regional	2	Good	6.2
40	-	R13P-1	Prampram	Dawhenya	63	61	40.6	Paved	Regional	2	Poor	7.0
41	-	R13P-2	Dawhenya	Afienea	61	72	7.1	Paved	Regional	2	Poor	7.0
42	-	R13P-3	Afienea	Dodowa	72	25	15.6	Paved	Regional	2	Poor	7.0
43	-	R18P-1	Anyaman	Sege	63	62	9.3	Gravel	Regional	2	Good	7.0
44	-	R18P-2	Sege	Aveyime	62	15	17.2	Paved	Regional	2	Fair	7.0
45	-	R18P-3	Aveyime	Mepe	15	64	10.6	Paved	Regional	2	Fair	7.0
46	-	F1G-1	Mepe	Peterkope	64	65	15.6	Gravel	Feeder	2	n.a	n.a
47	-	R22P-1	Doryum	Ayikuma	71	24	18.7	Paved	Regional	2	Poor	7.0
48	-	R40P-1	Dodowa	Adenta	25	29	20.9	Paved	Regional	2	Fair	7.5
49	-	R30P-1	Odumase	Somanya	22	23	4.5	Paved	Regional	2	Fair	7.8
50	-	R10G-1	Aflao	Dzodze	41	70	43.6	Gravel	Regional	2	Fair	7.5
51	-	R10P-2	Dzodze	Kpetoe	70	69	24.1	Paved	Regional	2	Poor	7.0
52	-	R10P-3	Kpetoe	Ho	69	11	43.9	Paved	Regional	2	Poor	7.0
53	-	R12G-1	Akatsi	Dzodze	26	70	25.1	Gravel	Regional	2	Good	10.0
54	-	R14G-1	Akatsi	Kpetoe	26	69	38.5	Gravel	Regional	2	Poor	10.0
55	-	R11P-1	Kase	Adafoa	18	84	20.0	Paved	Regional	2	Poor	7.3
56	-	F2P-1	Somanya	Akuse Jct.	23	67	6.7	Paved	Feeder	2	Fair	n.a
57	-	F2P-2	Akuse Jct.	Kpong Dam Jct.	67	68	8.8	Paved	Feeder	2	Fair	n.a
58	-	F2P-3	Kpong Dam Jct.	Kagyanya	68	48	6.4	Paved	Feeder	2	Fair	n.a
59	-	F2P-4	Kagyanya	Asutsuare	48	13	2.3	Paved	Feeder	n.a	Fair	n.a
60	-	F3P-1	Kpong Dam Jct.	Ageteklekyi	68	46	8.9	Paved	Feeder	2	n.a	n.a
61	-	F3G-2	Ageteklekyi	Dokotsi	46	47	13.1	Gravel	Feeder	2	n.a	n.a
62	-	F4G-1	Ageteklekyi	Adome	46	52	12.7	Gravel	Feeder	2	n.a	n.a
63	-	F5G-1	Dadaboe	Agove	49	50	7.0	Gravel	Feeder	2	n.a	n.a
64	-	F5G-2	Agove	Kpedzeglo	50	51	8.8	Gravel	Feeder	2	n.a	n.a
65	-	F6G-1	Adidome	Volo	6	4	27.0	Gravel	Feeder	2	n.a	n.a
66	-	F6G-2	Volo	Dufor-Adidome	4	2	9.5	Gravel	Feeder	2	n.a	n.a
67	-	F7G-1	Osi-Abura	Kpolukope	55	56	5.1	Gravel	Feeder	1	n.a	n.a

Table A4-1 Link Data of Road Network for Traffic Demand Forecast (2)

No.	Corridor	Code	Node Name		Node No.		Distance (km)	Surface	Class	No. of Lane	Condition	Width (m)
			From	To	From	To						
68	-	T1E-1	Agove	Adidokpavui	50	3	20.0	Earth	Track	1	n.a	n.a
69	-	T1E-2	Adidokpavui	Kpomkpo	3	1	14.7	Earth	Track	1	n.a	n.a
70	Project	ALT F8P-1	Asutsuare Jct.	Jerusalem	59	60	10.4	Paved	Feeder	2	n.a	n.a
71	Project	F8P-2	Jerusalem	Asutsuare	60	13	11.4	Paved	Feeder	2	n.a	n.a
72	Project	F8P-3	Asutsuare	Volivo	13	14	6.3	Paved	Feeder	2	n.a	n.a
73	Project	F10G-1	Dufor-Adidome	Dokotsi	47	2	6.1	Gravel	Feeder	2	n.a	n.a
74	Project	F10G-2	Dokotsi	Juapong	47	53	15.8	Gravel	Feeder	2	n.a	n.a
75	Project	F11G-1	Kpomkpo	Podoe-Dufo	1	45	4.2	Gravel	Feeder	2	n.a	n.a
76	Project	F11G-2	Podoe-Dufo	Frankadua	45	54	5.2	Gravel	Feeder	2	n.a	n.a
77	Project	ALT1 NC1-1	Jerusalem	Kagyanya	60	48	20.0	Paved	National	2	Fair	n.a
78	Project	ALT1 NC1-2	Kagyanya	Dokotsi	48	47	8.3	Paved	National	2	Fair	n.a
79	Project	ALT4 NC2-1	Jerusalem	Volivo	60	14	30.0	Paved	National	2	Fair	n.a
80	Project	ALT4 NC2-2	Volivo	Dufor-Adidome	14	2	1.9	Paved	National	2	Fair	n.a
81	Project	ALT4 NC2-3	Dufor-Adidome	Dokotsi	2	47	6.4	Paved	National	2	Fair	n.a
82	Project	ALT NC3-1	Dokotsi	Kpomkpo	47	1	14.3	Paved	National	2	Fair	n.a
83	Project	ALT NC3-2	Kpomkpo	Kpolukope	1	56	9.7	Paved	National	2	Fair	n.a
84	Project	ALT NC3-3	Kpolukope	Asikuma Jct.	56	8	9.7	Paved	National	2	Fair	n.a
85	Project	ALT5 F11G-1	Volivo	Aveyime	14	15	18.7	Paved	National	2	Fair	n.a
86	Coastal	N1P-9	Tema Roundabout	Tetteh Quashie	73	74	19.2	Paved	National	2	Good	7.3
87	Coastal	N1P-10	Tetteh Quashie	Accra	74	28	5.9	Paved	National	2	Good	10.5
88	Coastal	N1P-11	Accra	Cape Coast	28	31	129.7	Paved	National	2	Good	8.9
89	Coastal	N1P-12	Cape Coast	Daboasi Jct.	31	32	58.8	Paved	National	2	Good	7.9
90	Coastal	N1P-13	Daboasi Jct.	Takoradi Port	32	33	28.7	Paved	National	2	Fair	8.0
91	Coastal	N1P-14	Takoradi Port	Elubo	33	44	138.6	Paved	National	2	Good	7.6
92	Eastern	N2P-15	Fume	Nkwanta	19	40	231.1	Paved	National	2	Good	8.8
93	Eastern	N2G-16	Nkwanta	Yendi	40	37	95.1	Gravel	National	2	Fair	8.2
94	Eastern	N2P-17	Yendi	Sakpiegu	37	82	12.2	Paved	National	2	Good	7.3
95	Eastern	N2G-18	Sakpiegu	Misiga	82	81	193.9	Gravel	National	2	Fair	8.1
96	Eastern	N2G-19	Misiga	Kulungugu	81	80	10.7	Gravel	National	2	Poor	9.6
97	-	N14G-1	Sakpiegu	Yawgu	82	42	100.2	Gravel	National	2	Good	8.1
98	-	N3P-2	Odumase	Koforidua	22	30	46.4	Paved	National	2	Fair	7.0
99	-	N4P-1	Tetteh Quashie	Adenta	74	29	9.8	Paved	National	2	Poor	7.3
100	-	N4P-2	Adenta	Koforidua	29	30	73.3	Paved	National	2	Good	7.3
101	-	N4P-3	Koforidua	Bunso	30	75	27.5	Paved	National	2	Good	7.2
102	Central	N6G-1	Accra	Bunso	28	75	87.6	Gravel	National	2	Fair	7.5
103	Central	N6P-2	Bunso	Kumasi	75	34	150.6	Paved	National	2	Good	7.4
104	-	N6P-3	Kumasi	Sunyani	34	35	122.8	Paved	National	2	Fair	7.8
105	-	N8P-1	Cape Coast	Anwiankwantsa	31	76	174.1	Paved	National	2	Fair	7.3
106	-	N10G-1	Daboasi Jct.	Anwiankwantsa	32	76	189.1	Gravel	National	2	Fair	8.1
107	-	N10P-2	Anwiankwantsa	Kumasi	76	34	45.0	Paved	National	2	Good	7.5
108	Central	N10P-3	Kumasi	Fufulsu Jct.	34	77	307.9	Paved	National	2	Good	8.3
109	Central	N10P-4	Fufulsu Jct.	Tamale	77	36	59.1	Paved	National	2	Poor	7.3
110	Central	N10P-5	Tamale	Bolgatanga	36	39	160.6	Paved	National	2	Fair	7.5
111	Central	N10P-6	Bolgatanga	Navrongo	39	79	30.3	Paved	National	2	Fair	7.3
112	Central	N10P-7	Navrongo	Paga	79	43	12.7	Paved	National	2	Fair	6.9
113	-	N11P-1	Bolgatanga	Misiga	39	81	83.5	Paved	National	2	Poor	7.7
114	Western	N12G-1	Elubo	Sunyani	44	35	322.9	Gravel	National	2	Poor	8.4
115	Western	N12P-2	Sunyani	Sawla	35	78	253.3	Paved	National	2	Good	7.9
116	Western	N12P-3	Sawla	Wa	78	38	95.2	Paved	National	2	Good	7.6
117	Western	N12P-4	Wa	Dowene	38	83	74.4	Paved	National	2	Good	8.3
118	-	N7G-1	Fufulsu Jct.	Sawla	77	78	147.7	Gravel	National	2	Poor	8.0
119	-	N13G-1	Navrongo	Dowene	79	83	157.4	Gravel	National	2	Poor	8.5
120	-	R201P-1	Yendi	Tamale	37	36	92.7	Paved	Regional	2	Fair	7.7
121	-	N4P-5	Mamfe	Koforidua	24	30	34.8	Paved	National	2	Fair	7.6
122	-	N4P-6	Mamfe	Adenta	24	29	31.32	Paved	National	2	Fair	7.6

Source: GHA Road Condition Survey, GHA
Lands Commission Topographical Map

Appendix 5 Results of Route Assignment

Table A5-1 Results of Route Assignment in 2016 (1)

(Unit: Vehicles)

Link No.	Corridor	Node Name		Passenger Car/ Pick-up	Minibus	Bus	Medium Truck	Heavy Truck	Trailer	Others	Total	CVR*
1	Eastern	Tema Port	Tema Roundabout	11,785	3,365	1,025	1,425	890	3,015	860	22,365	25.9%
2	Eastern	Tema Roundabout	Afienny	4,196	1,748	496	638	343	1,124	346	8,891	26.0%
3	Eastern	Afienny	Doryum	4,796	2,197	405	741	447	1,288	484	10,358	25.3%
4	Eastern	Doryum	Asutsuare Jct.	2,843	2,241	470	740	502	1,363	491	8,650	32.7%
5	Eastern	Asutsuare Jct.	Akuse Jct.	1,489	916	113	217	92	122	4	2,953	11.2%
6	Eastern	Akuse Jct.	Kpong	1,469	1,898	205	312	44	99	5	4,032	8.8%
7	Eastern	Kpong	Atimpoku	2,142	3,081	165	283	38	64	12	5,785	4.8%
8	Eastern	Atimpoku	Adome	2,070	1,945	130	236	46	42	13	4,482	5.2%
9	Eastern	Adome	Juapong	2,070	1,945	130	236	46	42	13	4,482	5.2%
10	Eastern	Juapong	Frankadua	2,029	1,936	130	234	46	35	12	4,422	5.0%
11	Eastern	Frankadua	Osi-Abura	2,029	1,936	130	234	46	35	12	4,422	5.0%
12	Eastern	Osi-Abura	Asikuma Jct.	2,029	1,936	130	234	46	35	12	4,422	5.0%
13	Eastern	Asikuma Jct.	Dafor	1,818	2,200	368	488	279	1,115	491	6,759	33.3%
14	Eastern	Dafor	Fume	1,440	2,010	346	453	259	1,110	491	6,109	36.1%
15	Coastal	Aflao	Akatsi	440	20	130	10	45	320	75	1,040	54.8%
16	Coastal	Akatsi	Sogakope	2,665	2,520	380	285	130	570	75	6,625	17.4%
17	Coastal	Sogakope	Peterkope	4,050	3,367	552	527	297	1,330	341	10,464	24.1%
18	Coastal	Peterkope	Kase	4,107	2,736	369	483	282	1,254	340	9,571	23.5%
19	Coastal	Kase	Sege	3,925	2,423	264	434	252	1,231	340	8,869	23.5%
20	Coastal	Sege	Nyigbenya	2,247	1,448	374	391	356	867	182	5,865	30.3%
21	Coastal	Ode-Opeo	Dawhenya	2,334	1,454	376	395	358	876	182	5,975	30.0%
22	Coastal	Dawhenya	Tema Roundabout	5,782	2,114	288	517	436	1,576	487	11,200	24.9%
23	-	Sogakope	Adidome	1,767	618	173	296	162	740	265	4,021	33.3%
24	-	Adidome	Dadaboe	1,009	537	172	251	150	738	265	3,122	42.4%
25	-	Dadaboe	Kpedzeglo	1,009	537	172	251	150	738	265	3,122	42.4%
26	-	Kpedzeglo	Mafi Asiekpe	1,009	537	172	251	150	738	265	3,122	42.4%
27	-	Mafi Asiekpe	Tsrefe	816	511	172	213	150	738	265	2,865	46.2%
28	-	Tsrefe	Ho	816	519	172	213	142	738	265	2,865	46.0%
29	-	Ho	Fume	350	301	139	144	136	710	265	2,045	61.1%
30	-	Asikuma Jct.	Dededu	1,363	1,629	110	182	33	47	0	3,364	5.6%
31	-	Dededu	Anyinawasi	1,363	1,629	110	182	33	47	0	3,364	5.6%
32	-	Anyinawasi	Sokode Gbogame	1,363	1,629	110	182	38	47	0	3,369	5.8%
33	-	Sokode Gbogame	Ho	1,363	1,629	110	182	38	47	0	3,369	5.8%
34	-	Kpong	Odumase	2,983	4,814	331	486	83	103	8	8,808	6.0%
35	-	Atimpoku	Akosombo	1,085	1,825	55	115	15	25	10	3,130	3.4%
36	-	Juapong	Padoe Dufo	43	8	0	2	0	7	1	61	13.1%
37	-	Padoe Dufo	Kpolukope	0	0	0	0	0	0	0	0	-
38	-	Kpolukope	Abutia Kloe	0	0	0	0	0	0	0	0	-
39	-	Abutia Kloe	Sokode Gbogame	0	0	0	0	0	0	0	0	-
40	-	Prampram	Dawhenya	1,793	1,497	0	125	0	471	160	4,046	15.6%
41	-	Dawhenya	Afienny	3,788	1,053	134	193	126	520	146	5,960	15.5%
42	-	Afienny	Dodowa	4,692	1,045	623	340	232	544	38	7,514	19.1%
43	-	Anyaman	Sege	1,793	1,497	0	125	0	471	160	4,046	15.6%
44	-	Sege	Aveyime	1,992	825	119	219	126	106	2	3,389	10.4%
45	-	Aveyime	Mepe	924	704	184	78	23	77	0	1,990	14.3%
46	-	Mepe	Peterkope	924	704	184	78	23	77	0	1,990	14.3%
47	-	Doryum	Ayikuma	3,271	2,201	305	524	61	123	8	6,493	7.7%
48	-	Dodowa	Adenta	4,704	1,050	623	345	232	547	38	7,539	19.1%
49	-	Odumase	Somanya	1,553	4,074	142	230	96	101	5	6,201	5.5%
50	-	Aflao	Dzodze	0	0	0	0	0	0	0	0	-
51	-	Dzodze	Kpetoe	0	0	0	0	0	0	0	0	-
52	-	Kpetoe	Ho	0	0	0	0	0	0	0	0	-
53	-	Akatsi	Dzodze	0	0	0	0	0	0	0	0	-
54	-	Akatsi	Kpetoe	0	0	0	0	0	0	0	0	-
55	-	Kase	Adafoa	0	0	0	0	0	0	0	0	-
56	-	Somanya	Akuse Jct.	1,190	875	101	178	92	101	4	2,541	11.7%
57	-	Akuse Jct.	Kpong Dam Jct.	1,155	1,368	147	213	68	88	3	3,042	10.1%
58	-	Kpong Dam Jct.	Kagyanya	1,120	1,861	193	247	44	75	2	3,542	8.9%
59	-	Kagyanya	Asutsuare	1,120	1,861	193	247	44	75	2	3,542	8.9%
60	-	Kpong Dam Jct.	Ageteklekyi	110	1	0	26	0	0	0	137	0.0%
61	-	Ageteklekyi	Dokotsi	110	1	0	26	0	0	0	137	0.0%
62	-	Ageteklekyi	Adome	0	0	0	0	0	0	0	0	-
63	-	Dadaboe	Agove	0	0	0	0	0	0	0	0	-

Table A5-1 Results of Route Assignment in 2016 (2)

(Unit: Vehicles)

Link No.	Corridor	Node Name		Passenger Car/ Pick-up	Minibus	Bus	Medium Truck	Heavy Truck	Trailer	Others	Total	CVR*
64	-	Agove	Kpedzeglo	0	0	0	0	0	0	0	0	-
65	-	Adidome	Volo	253	36	0	38	0	0	0	327	0.0%
66	-	Volo	Dufor-Adidome	249	21	0	36	0	0	0	306	0.0%
67	-	Osi-Abura	Kpoluko	0	0	0	0	0	0	0	0	-
68	-	Agove	Adidokpavui	0	0	0	0	0	0	0	0	-
69	-	Adidokpavui	Kpomkpo	0	0	0	0	0	0	0	0	-
70	Project	Asutsuare Jct.	Jerusalem	2,531	2,379	524	565	472	1,264	486	8,221	33.4%
71	Project	Jerusalem	Asutsuare	152	23	30	25	15	39	0	284	29.6%
72	Project	Asutsuare	Volivo	1,078	1,848	183	218	45	86	2	3,460	9.1%
73	Project	Dufor-Adidome	Dokotsi	0	0	0	0	0	0	0	0	-
74	Project	Dokotsi	Juapong	0	0	0	0	0	0	0	0	-
75	Project	Kpomkpo	Podoe-Dufo	43	8	0	2	0	7	1	61	13.1%
76	Project	Podoe-Dufo	Frankadua	0	0	0	0	0	0	0	0	-
77	Project	Jerusalem	Kagyanya	0	0	0	0	0	0	0	0	-
78	Project	Kagyanya	Dokotsi	0	0	0	0	0	0	0	0	-
79	Project	Jerusalem	Volivo	2,380	2,358	496	542	457	1,223	486	7,942	33.5%
80	Project	Volivo	Dufor-Adidome	2,315	2,957	386	582	311	1,139	487	8,177	28.4%
81	Project	Dufor-Adidome	Dokotsi	2,280	2,938	386	598	311	1,134	487	8,134	28.5%
82	Project	Dokotsi	Kpomkpo	2,170	2,937	386	572	311	1,134	487	7,997	29.0%
83	Project	Kpomkpo	Kpoluko	2,129	2,928	386	570	311	1,127	486	7,937	29.1%
84	Project	Kpoluko	Asikuma Jct.	2,129	2,928	386	570	311	1,127	486	7,937	29.1%
85	Project	Volivo	Aveyime	1,716	1,478	371	234	225	189	3	4,216	18.7%
86	Coastal	Tema Roundabout	Tetteh Quashie	5,673	2,156	555	572	219	616	42	9,833	14.6%
87	Coastal	Tetteh Quashie	Accra	10,543	4,650	1,330	1,383	536	1,215	95	19,752	16.1%
88	Coastal	Accra	Cape Coast	58	15	0	20	16	45	55	209	55.5%
89	Coastal	Cape Coast	Daboasi Jct.	6	0	0	0	10	30	55	101	94.1%
90	Coastal	Daboasi Inc.	Takoradi Port	26	0	0	0	10	15	5	56	53.6%
91	Coastal	Takoradi Port	Elubo	26	0	0	0	10	15	5	56	53.6%
92	Eastern	Fume	Nkwanta	1,769	2,311	485	597	395	1,820	755	8,132	42.5%
93	Eastern	Nkwanta	Yendi	447	66	180	333	329	1,765	675	3,795	77.7%
94	Eastern	Yendi	Sakpiegu	15	0	0	0	0	0	0	15	0.0%
95	Eastern	Sakpiegu	Misiga	0	0	0	0	0	0	0	0	-
96	Eastern	Misiga	Kulungugu	0	0	0	0	0	0	0	0	-
97	-	Sakpiegu	Yawgu	15	0	0	0	0	0	0	15	0.0%
98	-	Odumase	Koforidua	3,047	3,484	388	457	111	111	17	7,615	8.2%
99	-	Tetteh Quashie	Adenta	6,942	3,277	921	909	324	638	53	13,064	14.8%
100	-	Adenta	Koforidua	1,317	1,030	0	0	0	0	0	2,347	0.0%
101	-	Koforidua	Bunso	0	4	10	13	11	0	0	38	55.3%
102	Central	Accra	Bunso	0	0	0	0	0	0	0	0	-
103	Central	Bunso	Kumasi	0	4	10	13	11	0	0	38	55.3%
104	-	Kumasi	Sunyani	245	146	205	233	109	245	235	1,418	56.0%
105	-	Cape Coast	Anwiankwantsa	0	0	0	0	0	0	0	0	-
106	-	Daboasi Jct.	Anwiankwantsa	0	0	0	0	0	0	0	0	-
107	-	Anwiankwantsa	Kumasi	0	0	0	0	0	0	0	0	-
108	Central	Kumasi	Fufulsu Jct.	0	0	0	0	0	0	0	0	-
109	Central	Fufulsu Jct.	Tamale	571	264	217	305	122	281	226	1,986	42.6%
110	Central	Tamale	Bolgatanga	90	18	57	148	239	1,391	456	2,399	89.3%
111	Central	Bolgatanga	Navrongo	70	27	34	115	221	1,363	444	2,274	90.7%
112	Central	Navrongo	Paga	20	0	20	110	240	1,370	455	2,215	94.1%
113	-	Bolgatanga	Misiga	0	0	0	0	0	0	0	0	-
114	Western	Elubo	Sunyani	26	0	0	0	4	15	5	50	48.0%
115	Western	Sawla	Sawla	467	291	255	334	156	300	245	2,048	46.7%
116	Western	Sawla	Wa	190	27	51	38	31	19	19	375	32.0%
117	Western	Wa	Dowene	50	27	46	34	31	19	19	226	50.9%
118	-	Fufulsu Jct.	Sawla	571	264	217	305	122	281	226	1,986	42.6%
119	-	Navrongo	Dowene	50	27	46	34	31	19	19	226	50.9%
120	-	Yendi	Tamale	432	66	160	334	324	1,770	675	3,761	77.9%
121	-	Mamfe	Koforidua	1,482	1,740	282	295	64	85	17	3,965	11.3%
122	-	Mamfe	Adenta	4,629	3,895	587	798	125	208	24	10,266	9.2%

Note: CVR – Commercial Vehicle Ratio

Source: Study Team

Table A5-2 Results of Route Assignment in 2026 (1)

(Unit: Vehicles)

Link No.	Corridor	Node Name		Passenger Car/ Pick-up	Minibus	Bus	Medium Truck	Heavy Truck	Trailer	Others	Total	CVR*
1	Eastern	Tema Port	Tema Roundabout	15,205	4,355	1,315	1,545	1,080	4,190	1,230	28,920	27.0%
2	Eastern	Tema Roundabout	Afienea	4,159	1,777	340	442	207	2,044	623	9,592	33.5%
3	Eastern	Afienea	Doryum	3,250	1,751	591	661	429	2,565	842	10,089	43.9%
4	Eastern	Doryum	Asutsuare Jct.	4,475	2,692	351	575	433	1,844	802	11,172	30.7%
5	Eastern	Asutsuare Jct.	Akuse Jct.	2,434	623	23	155	53	648	393	4,329	25.8%
6	Eastern	Akuse Jct.	Kpong	1,479	2,786	321	344	155	185	23	5,293	12.9%
7	Eastern	Kpong	Atimpoku	2,157	4,112	337	383	38	126	30	7,183	7.4%
8	Eastern	Atimpoku	Adome	2,223	2,653	297	351	44	118	34	5,720	8.6%
9	Eastern	Adome	Juapong	2,866	2,653	297	351	44	118	34	6,363	7.7%
10	Eastern	Juapong	Frankadua	2,737	2,635	292	331	44	102	30	6,171	7.6%
11	Eastern	Frankadua	Osi-Abura	2,737	2,635	292	331	44	102	30	6,171	7.6%
12	Eastern	Osi-Abura	Asikuma Jct.	2,737	2,635	292	331	44	102	30	6,171	7.6%
13	Eastern	Asikuma Jct.	Dafor	1,469	1,826	435	463	299	1,660	678	6,830	45.0%
14	Eastern	Dafor	Fume	1,035	1,581	406	429	281	1,655	678	6,065	49.8%
15	Coastal	Aflao	Akatsi	558	27	185	10	65	495	105	1,445	58.8%
16	Coastal	Akatsi	Sogakope	3,285	3,073	510	315	155	770	110	8,218	18.8%
17	Coastal	Sogakope	Peterkope	4,636	3,527	577	655	449	1,468	334	11,646	24.3%
18	Coastal	Peterkope	Kase	5,214	2,962	518	684	504	1,445	332	11,659	24.0%
19	Coastal	Kase	Sege	4,560	2,502	380	587	462	1,427	332	10,250	25.4%
20	Coastal	Sege	Nyigbenya	2,149	2,947	272	572	409	713	128	7,190	21.2%
21	Coastal	Ode-Opeo	Dawhenya	2,300	2,953	271	565	408	730	128	7,355	20.9%
22	Coastal	Dawhenya	Tema Roundabout	4,906	2,537	528	804	755	1,810	592	11,932	30.9%
23	-	Sogakope	Adidome	2,632	1,712	298	452	313	821	227	6,455	25.7%
24	-	Adidome	Dadaboe	1,245	786	155	325	208	742	226	3,687	36.1%
25	-	Dadaboe	Kpedzeglo	1,245	785	155	325	208	742	226	3,686	36.1%
26	-	Kpedzeglo	Mafi Asiekpe	1,245	785	155	325	208	742	226	3,686	36.1%
27	-	Mafi Asiekpe	Tsrefe	995	726	155	265	208	742	226	3,317	40.1%
28	-	Tsrefe	Ho	995	736	155	265	199	742	226	3,318	39.8%
29	-	Ho	Fume	893	850	110	182	176	699	225	3,135	38.6%
30	-	Asikuma Jct.	Dededu	2,588	2,754	154	183	35	52	0	5,766	4.2%
31	-	Dededu	Anyinawasi	2,588	2,754	154	183	35	52	0	5,766	4.2%
32	-	Anyinawasi	Sokode Gbogame	2,588	2,754	154	183	38	52	0	5,769	4.2%
33	-	Sokode Gbogame	Ho	2,588	2,754	154	183	38	52	0	5,769	4.2%
34	-	Kpong	Odumase	2,813	6,174	631	637	293	201	12	10,761	10.6%
35	-	Atimpoku	Akosombo	1,395	2,345	75	135	15	20	10	3,995	3.0%
36	-	Juapong	Padoe Dufo	129	18	6	21	0	16	4	194	13.4%
37	-	Padoe Dufo	Kpolukope	0	0	0	0	0	0	0	0	-
38	-	Kpolukope	Abutia Kloe	0	0	0	0	0	0	0	0	-
39	-	Abutia Kloe	Sokode Gbogame	0	0	0	0	0	0	0	0	-
40	-	Prampram	Dawhenya	3,013	217	142	132	179	774	248	4,705	28.5%
41	-	Dawhenya	Afienea	2,744	1,338	411	407	218	699	216	6,033	25.6%
42	-	Afienea	Dodowa	5,206	2,576	450	387	124	305	21	9,069	9.9%
43	-	Anyaman	Sege	3,013	217	142	132	179	774	248	4,705	28.5%
44	-	Sege	Aveyime	2,608	999	39	236	145	59	45	4,131	7.0%
45	-	Aveyime	Mepe	1,907	856	61	65	69	135	4	3,097	8.7%
46	-	Mepe	Peterkope	1,907	856	61	65	69	135	4	3,097	8.7%
47	-	Doryum	Ayikuma	3,502	1,752	520	400	124	848	64	7,210	21.6%
48	-	Dodowa	Adenta	5,231	2,597	450	399	124	314	21	9,136	9.9%
49	-	Odumase	Somanya	2,667	5,443	60	185	52	181	176	8,764	5.4%
50	-	Aflao	Dzodze	47	2	0	0	0	0	0	49	0.0%
51	-	Dzodze	Kpetoe	245	227	0	0	0	0	0	472	0.0%
52	-	Kpetoe	Ho	245	227	0	0	0	0	0	472	0.0%
53	-	Akatsi	Dzodze	198	225	0	0	0	0	0	423	0.0%
54	-	Akatsi	Kpetoe	0	0	0	0	0	0	0	0	-
55	-	Kase	Adafoa	0	0	0	0	0	0	0	0	-
56	-	Somanya	Akuse Jct.	2,261	1,713	13	136	56	181	176	4,536	9.4%
57	-	Akuse Jct.	Kpong Dam Jct.	1,292	1,183	12	35	3	467	217	3,209	21.8%
58	-	Kpong Dam Jct.	Kagyanya	1,392	1,787	151	238	72	102	132	3,874	11.8%
59	-	Kagyanya	Asutsuare	1,392	1,787	151	238	72	102	132	3,874	11.8%
60	-	Kpong Dam Jct.	Ageteklekyi	643	1,559	161	89	136	43	0	2,631	12.9%
61	-	Ageteklekyi	Dokotsi	0	1,559	161	89	136	43	0	1,988	17.1%
62	-	Ageteklekyi	Adome	643	0	0	0	0	0	0	643	0.0%
63	-	Dadaboe	Agove	0	0	0	0	0	0	0	0	-

Table A5-2 Results of Route Assignment in 2026 (2)

(Unit: Vehicles)

Link No.	Corridor	Node Name		Passenger Car/ Pick-up	Minibus	Bus	Medium Truck	Heavy Truck	Trailer	Others	Total	CVR*
64	-	Agove	Kpedzeglo	0	1	0	0	0	0	0	1	0.0%
65	-	Adidome	Volo	701	878	141	120	89	75	1	2,005	15.3%
66	-	Volo	Dufor-Adidome	696	858	141	118	89	75	1	1,978	15.5%
67	-	Osi-Abura	Kpoluko	0	0	0	0	0	0	0	0	-
68	-	Agove	Adidokpavui	0	1	0	0	0	0	0	1	0.0%
69	-	Adidokpavui	Kpomkpo	0	1	0	0	0	0	0	1	0.0%
70	Project	Asutsuare Jct.	Jerusalem	3,998	2,404	336	431	448	1,760	565	9,942	31.3%
71	Project	Jerusalem	Asutsuare	184	33	24	26	10	45	0	322	24.5%
72	Project	Asutsuare	Volivo	1,409	1,777	110	211	57	112	132	3,808	10.8%
73	Project	Dufor-Adidome	Dokotsi	0	0	0	0	0	0	0	0	-
74	Project	Dokotsi	Juapong	0	0	0	0	0	0	0	0	-
75	Project	Kpomkpo	Podoe-Dufo	129	18	6	21	0	16	4	194	13.4%
76	Project	Podoe-Dufo	Frankadua	0	0	0	0	0	0	0	0	-
77	Project	Jerusalem	Kagyanya	0	0	0	0	0	0	0	0	-
78	Project	Kagyanya	Dokotsi	0	0	0	0	0	0	0	0	-
79	Project	Jerusalem	Volivo	3,814	2,371	312	405	436	1,717	565	9,620	31.5%
80	Project	Volivo	Dufor-Adidome	3,403	2,822	368	496	380	1,691	656	9,816	31.5%
81	Project	Dufor-Adidome	Dokotsi	2,702	3,379	508	590	470	1,668	657	9,974	33.1%
82	Project	Dokotsi	Kpomkpo	2,702	3,295	348	502	333	1,626	657	9,463	31.3%
83	Project	Kpomkpo	Kpoluko	2,573	3,278	343	481	333	1,610	653	9,271	31.7%
84	Project	Kpoluko	Asikuma Jct.	2,573	3,278	343	481	333	1,610	653	9,271	31.7%
85	Project	Volivo	Aveyime	2,989	1,779	192	206	242	201	49	5,658	12.1%
86	Coastal	Tema Roundabout	Tetteh Quashie	9,155	3,086	819	768	197	600	39	14,664	11.3%
87	Coastal	Tetteh Quashie	Accra	13,564	7,305	1,720	1,600	583	1,315	105	26,192	14.2%
88	Coastal	Accra	Cape Coast	64	20	0	15	23	50	45	217	54.4%
89	Coastal	Cape Coast	Daboasi Jct.	16	0	0	0	17	25	45	103	84.5%
90	Coastal	Daboasi Inc.	Takoradi Port	38	0	0	0	17	20	5	80	52.5%
91	Coastal	Takoradi Port	Elubo	38	0	0	0	17	20	5	80	52.5%
92	Eastern	Fume	Nkwanta	1,845	2,427	511	610	455	2,352	904	9,104	46.4%
93	Eastern	Nkwanta	Yendi	819	660	276	438	407	2,310	829	5,739	66.6%
94	Eastern	Yendi	Sakpiegu	20	356	5	5	0	0	0	386	1.3%
95	Eastern	Sakpiegu	Misiga	0	356	0	0	0	0	0	356	0.0%
96	Eastern	Misiga	Kulungugu	0	0	0	0	0	0	0	0	-
97	-	Sakpiegu	Yawgu	20	0	5	5	0	0	0	30	16.7%
98	-	Odumase	Koforidua	3,517	5,169	595	551	272	273	193	10,570	12.6%
99	-	Tetteh Quashie	Adenta	10,509	5,865	1,339	1,063	401	856	66	20,099	13.2%
100	-	Adenta	Koforidua	1,779	2,008	236	254	70	137	14	4,498	10.2%
101	-	Koforidua	Bunso	458	613	129	155	113	588	226	2,282	46.3%
102	Central	Accra	Bunso	0	0	0	0	0	0	0	0	-
103	Central	Bunso	Kumasi	458	613	129	155	113	588	226	2,282	46.3%
104	-	Kumasi	Sunyani	341	773	369	405	209	751	394	3,242	53.1%
105	-	Cape Coast	Anwiankwantsa	0	0	0	0	0	0	0	0	-
106	-	Daboasi Jct.	Anwiankwantsa	0	0	0	0	0	0	0	0	-
107	-	Anwiankwantsa	Kumasi	0	0	0	0	0	0	0	0	-
108	Central	Kumasi	Fufulsu Jct.	502	6	0	0	0	0	0	508	0.0%
109	Central	Fufulsu Jct.	Tamale	1,094	548	388	458	143	288	249	3,168	33.7%
110	Central	Tamale	Bolgatanga	124	53	81	199	332	1,992	611	3,392	88.9%
111	Central	Bolgatanga	Navrongo	85	416	30	133	301	1,946	587	3,498	81.9%
112	Central	Navrongo	Paga	30	0	30	170	405	2,440	745	3,820	94.8%
113	-	Bolgatanga	Misiga	0	356	0	0	0	0	0	356	0.0%
114	Western	Elubo	Sunyani	38	0	0	0	2	20	5	65	41.5%
115	Western	Sunyani	Sawla	526	955	431	517	251	791	413	3,884	48.6%
116	Western	Sawla	Wa	228	416	53	66	109	503	164	1,539	53.9%
117	Western	Wa	Dowene	55	416	48	61	109	503	164	1,356	60.8%
118	-	Fufulsu Jct.	Sawla	592	542	388	458	143	288	249	2,660	40.2%
119	-	Navrongo	Dowene	55	416	48	61	109	503	164	1,356	60.8%
120	-	Yendi	Tamale	813	304	258	456	406	2,324	829	5,390	70.8%
121	-	Mamfe	Koforidua	1,933	2,455	279	277	103	699	63	5,809	19.7%
122	-	Mamfe	Adenta	5,105	4,149	800	653	227	459	41	11,434	13.4%

Note: CVR – Commercial Vehicle Ratio

Source: Study Team

Table A5-3 Results of Route Assignment in 2036 (1)

(Unit: Vehicles)

Link No.	Corridor	Node Name		Passenger Car/ Pick-up	Minibus	Bus	Medium Truck	Heavy Truck	Trailer	Others	Total	CVR*
1	Eastern	Tema Port	Tema Roundabout	17,300	4,975	1,490	2,145	1,465	4,930	1,615	33,920	28.0%
2	Eastern	Tema Roundabout	Afienva	4,570	1,869	438	607	511	2,008	835	10,838	35.0%
3	Eastern	Afienva	Doryum	3,808	2,410	374	683	514	2,700	1,103	11,592	40.5%
4	Eastern	Doryum	Asutsuare Jct.	4,532	3,111	399	644	545	2,071	847	12,149	31.8%
5	Eastern	Asutsuare Jct.	Akuse Jct.	1,747	1,251	24	195	16	129	1	3,363	5.1%
6	Eastern	Akuse Jct.	Kpong	3,912	2,635	378	308	111	118	0	7,462	8.1%
7	Eastern	Kpong	Atimpoku	3,403	4,418	308	374	39	50	9	8,601	4.7%
8	Eastern	Atimpoku	Adome	3,447	2,761	256	304	47	37	15	6,867	5.2%
9	Eastern	Adome	Juapong	4,112	3,525	256	304	47	37	15	8,296	4.3%
10	Eastern	Juapong	Frankadua	3,837	3,511	256	303	47	26	11	7,991	4.3%
11	Eastern	Frankadua	Osi-Abura	3,837	3,511	256	303	47	26	11	7,991	4.3%
12	Eastern	Osi-Abura	Asikuma Jct.	3,902	3,560	294	346	154	889	65	9,210	15.2%
13	Eastern	Asikuma Jct.	Dafor	1,575	1,633	423	415	384	1,920	837	7,187	49.6%
14	Eastern	Dafor	Fume	1,104	1,381	399	378	366	1,915	837	6,380	55.1%
15	Coastral	Aflao	Akatsi	730	31	188	4	74	559	170	1,756	56.4%
16	Coastral	Akatsi	Sogakope	3,988	3,405	507	296	172	805	174	9,347	17.7%
17	Coastral	Sogakope	Peterkope	4,989	4,381	590	562	261	1,274	446	12,503	20.6%
18	Coastral	Peterkope	Kase	5,476	4,095	508	606	336	1,227	446	12,694	19.8%
19	Coastral	Kase	Sege	4,730	3,534	374	508	296	1,238	446	11,126	21.2%
20	Coastral	Sege	Nyigbenya	2,201	2,086	312	465	524	1,062	138	6,788	30.0%
21	Coastral	Ode-Opeo	Dawhenya	2,420	2,099	314	471	555	1,085	138	7,082	29.5%
22	Coastral	Dawhenya	Tema Roundabout	4,286	2,749	263	645	630	2,379	720	11,672	34.2%
23	-	Sogakope	Adidome	2,898	1,288	150	282	89	434	273	5,414	17.5%
24	-	Adidome	Dadaboe	1,761	1,144	123	252	63	432	273	4,048	22.0%
25	-	Dadaboe	Kpedzeglo	1,761	1,144	123	252	63	432	273	4,048	22.0%
26	-	Kpedzeglo	Mafi Asiekpe	1,761	1,144	123	252	63	432	273	4,048	22.0%
27	-	Mafi Asiekpe	Tsrefe	1,484	1,120	123	195	63	432	273	3,690	24.1%
28	-	Tsrefe	Ho	1,484	1,130	123	195	54	432	273	3,691	23.9%
29	-	Ho	Fume	657	753	58	78	103	647	279	2,575	42.2%
30	-	Asikuma Jct.	Dededu	3,435	3,553	343	388	166	448	12	8,345	11.6%
31	-	Dededu	Anyinawasi	3,435	3,553	343	388	166	448	12	8,345	11.6%
32	-	Anyinawasi	Sokode Gbogame	3,435	3,553	343	388	169	448	12	8,348	11.6%
33	-	Sokode Gbogame	Ho	3,653	3,553	343	388	169	448	12	8,566	11.3%
34	-	Kpong	Odumase	3,950	5,889	552	498	203	231	13	11,336	8.8%
35	-	Atimpoku	Akosombo	1,575	2,650	80	165	20	25	10	4,525	3.0%
36	-	Juapong	Padoe Dufo	271	12	0	3	0	11	4	301	5.0%
37	-	Padoe Dufo	Kpolukope	218	0	0	0	0	0	0	218	0.0%
38	-	Kpolukope	Abutia Kloe	218	0	0	0	0	0	0	218	0.0%
39	-	Abutia Kloe	Sokode Gbogame	218	0	0	0	0	0	0	218	0.0%
40	-	Prampram	Dawhenya	2,580	1,575	11	90	117	644	308	5,325	20.3%
41	-	Dawhenya	Afienva	1,579	1,262	133	233	432	1,550	274	5,463	43.7%
42	-	Afienva	Dodowa	4,035	3,005	515	429	125	318	24	8,451	11.6%
43	-	Anyaman	Sege	2,580	1,575	11	90	117	644	308	5,325	20.3%
44	-	Sege	Aveyime	2,581	689	119	211	385	508	6	4,499	22.6%
45	-	Aveyime	Mepe	1,487	611	109	140	96	116	1	2,560	12.6%
46	-	Mepe	Peterkope	1,487	611	109	140	96	116	1	2,560	12.6%
47	-	Doryum	Ayikuma	3,879	2,369	291	305	82	738	288	7,952	17.6%
48	-	Dodowa	Adenta	4,063	3,025	515	444	125	328	24	8,524	11.6%
49	-	Odumase	Somanya	2,709	5,757	298	357	120	205	8	9,454	6.7%
50	-	Aflao	Dzodze	29	4	47	1	1	26	0	108	68.5%
51	-	Dzodze	Kpetoe	150	396	103	43	8	70	1	771	23.6%
52	-	Kpetoe	Ho	150	396	103	43	8	70	1	771	23.6%
53	-	Akatsi	Dzodze	121	391	56	42	7	44	1	662	16.3%
54	-	Akatsi	Kpetoe	0	0	0	0	0	0	0	0	-
55	-	Kase	Adafoa	0	0	0	0	0	0	0	0	-
56	-	Somanya	Akuse Jct.	2,131	1,956	250	316	121	205	6	4,985	11.7%
57	-	Akuse Jct.	Kpong Dam Jct.	2,586	1,688	250	199	54	266	6	5,049	11.4%
58	-	Kpong Dam Jct.	Kagyanya	1,885	2,050	308	261	83	172	1	4,760	11.8%
59	-	Kagyanya	Asutsuare	1,885	2,050	308	261	83	172	1	4,760	11.8%
60	-	Kpong Dam Jct.	Ageteklekyi	1,114	1,080	196	128	85	129	2	2,734	15.1%
61	-	Ageteklekyi	Dokotsi	449	317	196	128	85	129	2	1,306	31.5%
62	-	Ageteklekyi	Adome	666	763	0	0	0	0	0	1,429	0.0%
63	-	Dadaboe	Agove	0	0	0	0	0	0	0	0	-

Table A5-3 Results of Route Assignment in 2036 (2)

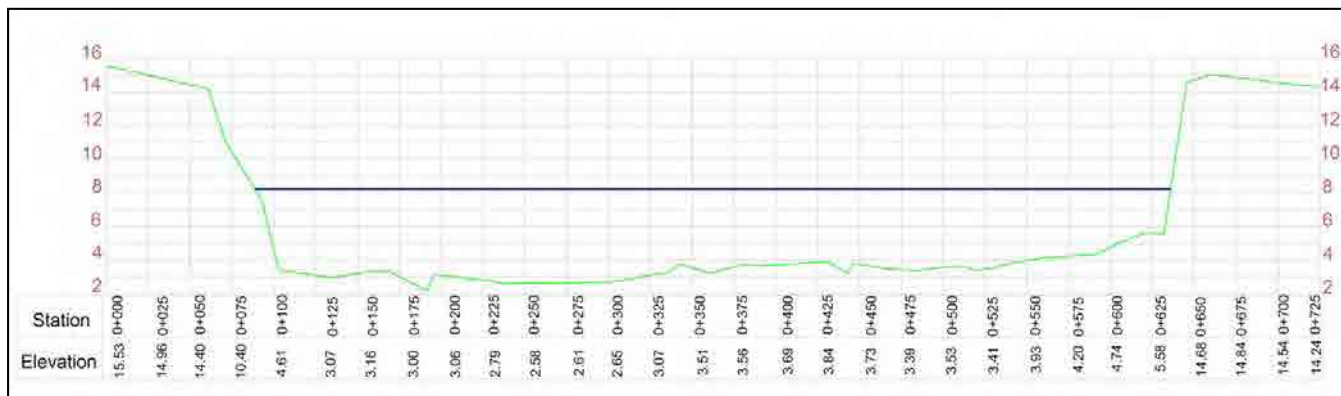
(Unit: Vehicles)

Link No.	Corridor	Node Name		Passenger Car/ Pick-up	Minibus	Bus	Medium Truck	Heavy Truck	Trailer	Others	Total	CVR*
64	-	Agove	Kpedzeglo	0	0	0	0	0	0	0	0	-
65	-	Adidome	Volo	410	33	23	8	0	0	0	474	4.9%
66	-	Volo	Dufor-Adidome	404	9	23	3	0	0	0	439	5.2%
67	-	Osi-Abura	Kpoluko	65	49	37	43	108	862	54	1,218	87.1%
68	-	Agove	Adidokpavui	0	0	0	0	0	0	0	0	-
69	-	Adidokpavui	Kpomkpo	0	0	0	0	0	0	0	0	-
70	Project	Asutsuare Jct.	Jerusalem	2,845	1,881	381	457	482	1,794	836	8,676	40.3%
71	Project	Jerusalem	Asutsuare	246	33	28	36	12	79	0	434	27.4%
72	Project	Asutsuare	Volivo	1,765	2,027	261	235	65	166	1	4,520	10.9%
73	Project	Dufor-Adidome	Dokotsi	0	0	0	0	0	0	0	0	-
74	Project	Dokotsi	Juapong	4	2	0	0	0	0	0	6	0.0%
75	Project	Kpomkpo	Podoe-Dufo	53	12	0	3	0	11	4	83	18.1%
76	Project	Podoe-Dufo	Frankadua	0	0	0	0	0	0	0	0	-
77	Project	Jerusalem	Kagyanya	0	0	0	0	0	0	0	0	-
78	Project	Kagyanya	Dokotsi	0	0	0	0	0	0	0	0	-
79	Project	Jerusalem	Volivo	2,795	1,864	353	434	470	1,761	836	8,513	40.2%
80	Project	Volivo	Dufor-Adidome	3,414	2,934	435	533	598	2,338	842	11,094	38.0%
81	Project	Dufor-Adidome	Dokotsi	3,045	2,925	459	530	598	2,332	842	10,731	39.4%
82	Project	Dokotsi	Kpomkpo	2,593	3,196	552	656	512	2,203	840	10,552	38.9%
83	Project	Kpomkpo	Kpoluko	2,540	3,184	552	653	512	2,192	836	10,469	39.1%
84	Project	Kpoluko	Asikuma Jct.	2,475	3,135	515	610	404	1,330	782	9,251	32.8%
85	Project	Volivo	Aveyime	2,397	1,183	370	246	515	621	7	5,339	28.3%
86	Coastal	Tema Roundabout	Tetteh Quashie	11,815	4,352	1,142	1,066	353	841	60	19,629	12.2%
87	Coastal	Tetteh Quashie	Accra	15,408	8,310	1,970	1,760	592	1,355	120	29,515	13.7%
88	Coastal	Accra	Cape Coast	65	25	0	10	17	70	75	262	61.8%
89	Coastal	Cape Coast	Daboasi Jct.	30	0	0	0	14	40	75	159	81.1%
90	Coastal	Daboasi Inc.	Takoradi Port	55	0	0	0	14	15	5	89	38.2%
91	Coastal	Takoradi Port	Elubo	55	0	0	0	14	15	5	89	38.2%
92	Eastern	Fume	Nkwanta	1,632	2,100	438	447	458	2,560	1,116	8,751	52.2%
93	Eastern	Nkwanta	Yendi	1,175	1,426	351	391	401	2,506	997	7,247	58.7%
94	Eastern	Yendi	Sakpiegu	446	273	103	89	58	20	41	1,030	21.6%
95	Eastern	Sakpiegu	Misiga	428	273	100	86	58	20	41	1,006	21.8%
96	Eastern	Misiga	Kulungugu	0	0	0	0	0	0	0	0	-
97	-	Sakpiegu	Yawgu	30	0	5	5	0	0	0	40	12.5%
98	-	Odumase	Koforidua	4,773	4,534	762	612	224	332	18	11,255	11.9%
99	-	Tetteh Quashie	Adenta	12,981	7,041	1,514	1,230	451	682	60	23,959	11.3%
100	-	Adenta	Koforidua	2,364	1,807	282	251	161	124	10	4,999	11.5%
101	-	Koforidua	Bunso	994	1,400	292	298	154	640	279	4,057	33.6%
102	Central	Accra	Bunso	0	0	0	0	0	0	0	0	-
103	Central	Bunso	Kumasi	994	1,400	292	298	154	640	279	4,057	33.6%
104	-	Kumasi	Sunyani	1,126	1,581	529	500	215	810	463	5,224	38.6%
105	-	Cape Coast	Anwiankwantsa	0	0	0	0	0	0	0	0	-
106	-	Daboasi Jct.	Anwiankwantsa	0	0	0	0	0	0	0	0	-
107	-	Anwiankwantsa	Kumasi	0	0	0	0	0	0	0	0	-
108	Central	Kumasi	Fufulsu Jct.	173	0	0	0	0	0	0	173	0.0%
109	Central	Fufulsu Jct.	Tamale	1,029	1,451	352	359	117	231	236	3,775	24.8%
110	Central	Tamale	Bolgatanga	225	53	96	187	300	2,163	731	3,755	87.6%
111	Central	Bolgatanga	Navrongo	651	334	211	248	344	2,147	758	4,693	73.7%
112	Central	Navrongo	Paga	40	0	35	125	385	2,565	890	4,040	95.9%
113	-	Bolgatanga	Misiga	428	273	100	86	58	20	41	1,006	21.8%
114	Western	Elubo	Sunyani	55	0	0	0	5	15	5	80	31.3%
115	Western	Sunyani	Sawla	1,443	1,785	593	608	257	852	477	6,015	36.2%
116	Western	Sawla	Wa	829	334	249	249	140	621	238	2,660	46.9%
117	Western	Wa	Dowene	643	334	246	247	140	621	238	2,469	50.4%
118	-	Fufulsu Jct.	Sawla	855	1,451	352	359	117	231	236	3,601	26.0%
119	-	Navrongo	Dowene	643	334	246	247	140	621	238	2,469	50.4%
120	-	Yendi	Tamale	755	1,153	244	356	346	2,500	956	6,310	64.1%
121	-	Mamfe	Koforidua	2,906	2,635	475	472	142	825	287	7,742	22.3%
122	-	Mamfe	Adenta	5,925	4,311	715	552	178	280	31	11,992	10.0%

Note: CVR – Commercial Vehicle Ratio

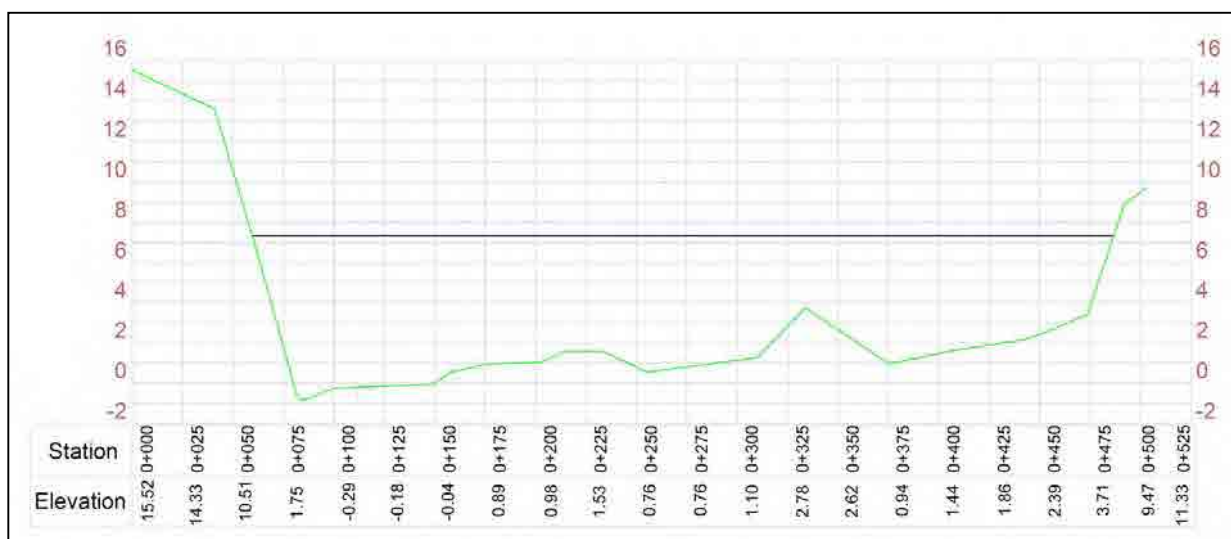
Source: Study Team

Appendix 6 Results of Bathymetric Survey



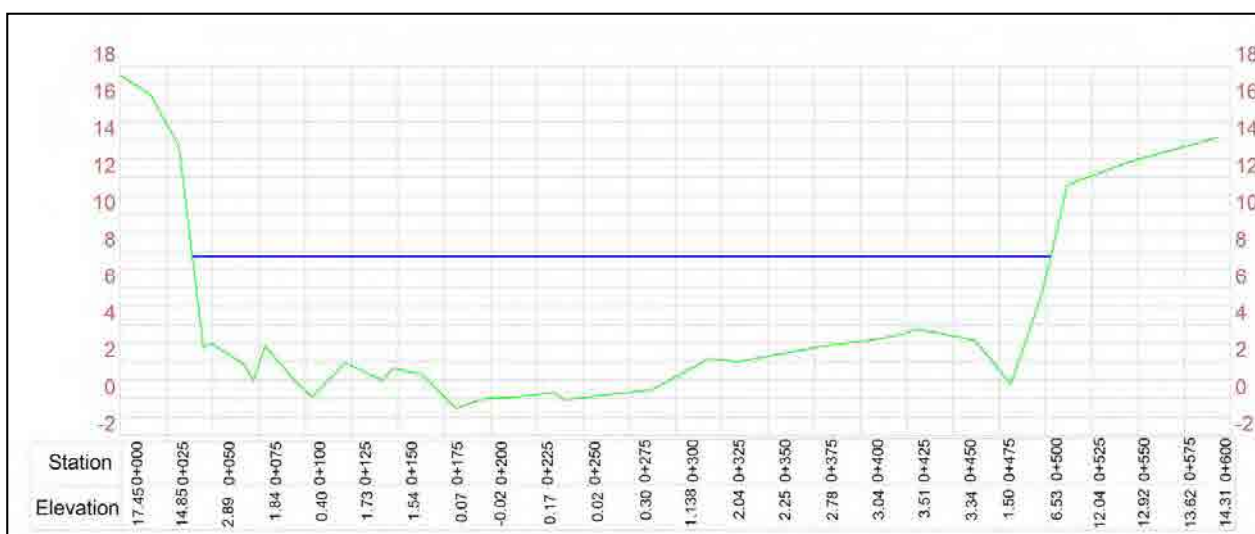
Source: Study Team

Figure A6-1 River Cross Section of the Alternative Bridge Locations B-1



Source: Study Team

Figure A6-2 River Cross Section of the Alternative Bridge Locations B-2



Source: Study Team

Figure A6-3 River Cross Section of the Alternative Bridge Locations B-3

Appendix 7 Results of Geotechnical Investigation

PROJECT : Proposed Bridge Over River Volta		BOREHOLE NO : 1			
CLIENT : CCIPADECO		LOCATION : Near Asutwae			
Boring Equipment : Shell & Auger Boring with rotary pendant Equipment : Pilon Wayfarer 1500 Investigator Rig		Date : 30th April - 2nd May, 2012			
Supervisor: Dr. Addo - Abedi Ground Coordinates : 402346.098, 158400.585		Logged By : Ransford Tetteh			
		Ground Height: 14.325			
Symbol	Soil / Rock Description	Depth (m)	SAMPLE		In-Situ Test SPT 'N'
			Type	No.	
	Loose, dark brown fine silty SAND	0.3	D	1	
W	Hard Light Brown/Yellowish Brown Sandy SILT	1			N = 51
W W		2	D	2	N = 64
W W		3			N = 98
W		4	D	3	N = 82
W W		4.9			N = 148
W W	Hard, Light Brown/Dark Grey Sandy SILT	5	D	4	N = 110
W		6			N = 89
	Hard, Chocolate Brown/Greyish Sandy CLAY	6.8			N = 86
		7			N = 75
		8	D	5	N = 66
	Hard, Dark Grey Sandy SILT Getting Wet at a Depth of 11.0m	9			N = 59
W W		10	D	6	N = 51
W W		11			N = 30
	Silt, Greyish/Dark Brown Sandy CLAY	11.6			
		12	D	7	
	Silt, Greyish/Dark Brown Sandy CLAY	13			N = 20
		14	D	8	N = 22
		14.7			N = 12
	Medium dense, reddish brown coarse grained SAND with pockets of clay and cobbles	15			N = 23
		16			N = 12
		17	D	9	N = 23
	Medium Dense, Reddish Brown/Yellowish Gravelly SAND (Gravel of Quartzitic Origin)	18.5			N = Refusal 50 Blows for 25mm Pen
W		19	D	10	
	Weak, weathered and slightly decomposed GNEISS rock	19.7			
		20			

Hole was terminated at 20.0m
Ground Elev: 14.325
Rockhead Elev: -6.675

Legend :
D - Disturbed sample recovery
N - Standard Pen. Test (SPT)
Ground Water First Encountered - Elev. -0.675
Final Groundwater Level - Elev 2.325

Record Of Borehole 1

Source: Study Team

Figure A7-1 Borehole Log at BH-A

PROJECT : Proposed Bridge Over river Volta		BOREHOLE NO : 2			
CLIENT : CCM/PADECO		LOCATION : Near Volivo			
Boring Equipment : Shell & Auger Boring with rotary pendant Equipment : Picon Wayfarer 1500 Investigator Rig		Date : 3th May - 5th May, 2012			
Supervisor; Dr. Addo - Abedi Ground Coordinates : 411301.316, 158737.219		Logged By : Ransford Tetteh			
		Ground Level: 62.015			
Symbol	Soil / Rock Description	Depth (m)	SAMPLE		In-Situ Test SPT 'N'
			Type	No.	
	Medium Dense Dark Brown Silty SAND with Organic Matter	1	D	1	N = 22
		2	D	2	N = 30
		2.4			
	Stiff to Hard Light Brown Sandy CLAY	3	D	3	N = 34
		4	D	4	N = 44
		5.6			
	Hard, dark brown coarse Sandy SILT	5	D	5	N = 73
		6	D	6	N = 67
		7			
X X	Hard to Stiff Dark Grey Sandy SILT getting wet at 11.0m depth	7	D	7	N = 94
		8	D	8	N = 92
X X		9	D	9	N = 70
		10	D	10	N = 11
X X		11	D	11	N = 16
		11.6			
	Medium Dense Reddish Brown Gravelly SAND	12			
		13	D	13	N = 11
	Medium Dense Reddish Brown Gravelly SAND	14	D	14	
		15			N = 10
		15.7			
	Medium Dense to Very Dense, Reddish Brown Coarse Grained SAND with Rounded Quartzitic Gravel	16			N = 12
		17	D	17	N = 70
		18.5			
	Weak, weathered and slightly decomposed GNEISS rock	18			N = Refusal 25Blows/25mmPen
		19			N = Refusal 25Blows/25mmPen
		20			
		Hole was terminated at 20.0m			
Legend :		Ground Elev: Elev 13.985			
D - Disturbed sample recovery		Rockhead Elev: -6.015			
N - Standard Pen. Test (SPT)					
Ground Water First Encountered: Elev 1.985					
Final Ground Water Level: Elev 3.385					
Record Of Borehole 2					

Source: Study Team

Figure A7-2 Borehole Log at BH-B

PROJECT: Preparatory Survey on Eastern Corridor Development Project(Geotechnical Investigation)				BOREHOLE No. BH# 3			
Equipment & Methods Rotary coring with Central Mine Equipment 6200N Broadway ST Louis MO.63147 drilling rig to 20.0m to produce 50mm cores.				Elevation:		Coordinates:	
CLIENT : JICA STUDY TEAM				LOCATION: Ameshiakope		Date Begun: 22/07/12	
						Date Completed: 22/07/11	
Description	Reduced Level (m)	Legend	Depth (Thick) (m)	Samples/ Tests			Field Records
				Depth (m)	Sample Type	No.	
Moist.Loose. dark brown/black. Sandy CLAY			0.20				
Moist, firm to stiff, dark brown /black Silty sandy CLAY			0.50	0.20 - 0.50	DS	1	
Moist, dense to firm,dark brown silty CLAY			1.00	0.60 - 1.00	DS	2	1.0
Moist, firm to stiff, dark brown,silty CLAY			1.50	1.00 - 1.50	DS	3	
			1.50	1.50 - 1.95	SPT	1	N=5 2,2,3 1.5
Moist, stiff, yellowish-brown, silty CLAY with occasional gravels			2.00	2.00 - 3.00	DS	4	2.0
			3.00	3.00 - 3.45	SPT	2	N=43 18,21,22 3.0
Moist, hard to compact, yellowish brown silty CLAY with quartzitic gravel.			3.50	3.50 - 4.50	DS	5	4.0
			4.50	4.50 - 4.95	SPT	3	N=51 24,25,26
Moist, stiff. Yellowish brown, silty CLAY with whitish quartz veins.			5.00	5.00 - 6.00	DS	6	5.0
			6.00	6.00 - 6.45	SPT	4	N= 54 6.0
Remarks:				LEGEND: SB - Small Bulk Sample U - Undisturbed sample S - Standard Penetration Test LB - Large Bulk Sample W - Water Sample R - Rock Sample V - Shear strength results from vane test			
				Logged by AAA		Checked by GKK	

Sheet 1 of 2

Source: Study Team

Figure A7-3 Borehole Log at BH-3 (1)

PROJECT: Preparatory Survey on Eastern Corridor Development Project(Geotechnical Investigation)											BH#3		
Equipment & Methods				LOCATION: Ameshiako				Date Begun: 22/07/12					
Rotary coring with Central Mine Equipment 6200N Broadway ST Louis MO.63147 drilling rig to 20.0m to produce 50m m cores.				CLIENT: JICA STUDY TEAM				Date Completed: 22/07/12					
Core Sizes: 0.050m			Orientation vertical			Ground Level:							
Depth(m)	Drilling Progress	Water return	Casing	Rock Quality							Description	O.D Level (m)	Legend
				discontinui ties	f	Cr	r	Core run	Thick ness (m)				
For information on this section of drill hole, see attached percussion drill log for BH# 04													
6.0													
	22/07/12 1.5m	98%				31%	0		(1.5)		Slightly strong to strong, greyish brown, slightly weathered, highly fractured, medium to coarse grained, micaceous biotite amphibole GNEISS.		
7.5													
Remarks: 1. BH -3 was terminated at a depth of 7.50m below existing ground level. 2. Ground water was encountered at a depth of 1.50m within the depth of exploration.				LEGEND: Cr - Percentage Core Recovery r - Rock Quality Designation f - No of fracture per metre				Sheet 2 of 2					
				Logged by AAA				Checked by GKK					

Source: Study Team

Figure A7-3 Borehole Log at BH-3 (2)

PROJECT: Preparatory Survey on Eastern Corridor Development Project in Ghana (Geotechnical Investigation)				BOREHOLE No. BH# 4						
Equipment & Methods Rotary coring with Central Mine Equipment 6200N Broadway ST Louis MO.63147 drilling rig to 20.0m to produce 50mm cores.				Elevation:		Coordinates:		Date Begun: 20/07/12		
CLIENT : JICA STUDY TEAM				LOCATION: Dorfor Adidome			Date Completed: 20/07/12			
Description	Reduced Level (m)	Legend	Depth (Thick) (m)	Samples / Tests			Field Records			
				Depth (m)	Sample Type	No.			Test	
Moist.Loose to dense. dark black, silty CLAY with rootlets. (ORGANIC TOPSOIL)			0.20							
Moist,dense to stiff, dark black/brownish ,Silty CLAY			0.50	0.20 - 0.50	DS	1				
Moist,dense to stiff, brownish black,silty CLAY			1.00	0.60 - 1.00	DS	2		1.0		
Moist, firm to stiff, dark brown,silty CLAY			1.50	1.00 - 1.50	DS	3				
				1.50 - 1.95	SPT	1	N=13	4,6,7 1.5		
Moist, firm to stiff, dark brown, silty CLAY				2.00 - 3.00	DS	4		2.0		
				3.00	3.00 - 3.45	SPT	2	N=17 5,7,10 3.0		
Moist, stiff to hard, greyish brown silty CLAY with occasional gravels				3.50 - 4.50	DS	5		4.0		
				4.50	4.50 - 4.95	SPT	3	N=40 10,13,27		
Moist, stiff to hard. greyish brown, clayey SILT. (Highly weathered biotite amphibole GNEISS)				5.00 - 5.50	DS	6		5.0		
				5.50 - 5.95	SPT	4	N= 58	8 15,18,40 6.0		
END OF PERCUSSION DRILLING			LEGEND: SB - Small Bulk Sample U - Undisturbed sample S - Standard Penetration Test LB - Large Bulk Sample W - Water Sample R - Rock Sample V - Shear strength results from vane test							
Remarks: BH - 4 was terminated at a depth of 5.95m below existing ground level.									Sheet 1 of 1	
				Logged by Andrew		Checked by GKK				

Source: Study Team

Figure A7-4 Borehole Log at BH-4

PROJECT: Preparatory Survey on Eastern Corridor Development Project in Ghana (Geotechnical Investigation)				BOREHOLE No. BH# 4a			
Equipment & Methods Rotary coring with Central Mine Equipment 6200N Broadway ST Louis MO.63147 drilling rig to 20.0m to produce 50mm cores.				Elevation:		Coordinates:	
CLIENT : JICA STUDY TEAM				LOCATION: Dorfor Adidome		Date Begun: 17/07/12	
						Date Completed: 19/07/12	
Description	Reduced Level (m)	Legend	Depth (Thick) (m)	Samples / Tests			Field Records
				Depth (m)	Sample Type	Test No.	
Moist, Loose to dense, dark brown, yellowish, silty CLAY with gravels.			0.20				
Moist, dense to stiff, dark brown, Silty CLAY			0.50	0.20 - 0.50	DS	1	
Moist, dense to stiff, reddish brown, silty CLAY			1.00	0.60 - 1.00	DS	2	1.0
Moist, stiff, dark brown, silty CLAY with shells			1.50	1.00 - 1.50	DS	3	
				1.50 - 1.95	SPT	1	N=15 3,6,9 1.5
Moist, stiff, reddish brown, silty CLAY				2.00 - 3.00	DS	4	2.0
			3.00	3.00 - 3.45	SPT	2	N=17 4,7,10 3.0
Moist, stiff, dark brown silty CLAY				3.50 - 4.50	DS	5	4.0
			4.50	4.50 - 4.95	SPT	3	N=25 6,11,14
Moist, stiff, greyish brown, clayey SILT. (Highly weathered biotite amphibole GNEISS)				5.00 - 5.50	DS	6	5.0
			6.00	5.50 - 5.95	SPT	4	N= 46 8,15,31 6.0
END OF PERCUSSION DRILLING			LEGEND: SB - Small Bulk Sample U - Undisturbed sample S - Standard Penetration Test LB - Large Bulk Sample W - Water Sample R - Rock Sample V - Shear strength results from vane test				
Remarks: BH - 4a was terminated at a depth of 5.95m below existing ground level.							Sheet 1 of 1
				Logged by AAA	Checked by GKK		

Source: Study Team

Figure A7-5 Borehole Log at BH-4a

PROJECT:		BOREHOLE No. BH 5				
Proposed Equipment & Methods		Elevation:	Coordinates:			
Picon Wayfarer 1500 light cable percussion rig with standard accessories for sinking 150mm diameter holes.			N			
			E		Date Begun: 30/06/12	
CLIENT :		LOCATION: Near Kpompo			Date Completed: 30/06/12	
Description	Reduced Level (m)	Legend	Depth (Thick) (m)	Samples/ Tests		Field Records
				Depth (m)	Sample Type: No.	
Soft ,moist, dark brown sandy CLAY		X	0.20			
Very stiff, moist, dark brown CLAY with traces of sand and gravel		X	0.50	SB	1	
		X	1.00	1.00 - 1.45	SPT 1	N= 21 5,6,5,5,6,5 1.0
Highly decomposed, yellowish/ greyish brown GNEISS		~	1.30			
Moderately decomposed, yellowish brown, light grey GNEISS		~	1.50	SB	2	
		~	2.00 - 2.45	SPT	2	N=40 9,17,12,9,10,9 2.0
		~	3.00 - 3.45	SPT	3	N= 40 6,6,8,12,10,10 3.0
Highly weathered, light grey greenish brown GNEISS		~	3.50			
		~	4.00 - 4.45	SPT	4	N= 53 11,19,15,13,14 4.0
		~	5.00 - 5.30	SPT	5	N>50 12,25,28,30 5.0
END OF PERCUSSION DRILLING			5.30			
Remarks:		LEGEND:				
1. Drill- hole was terminated at a depth of 5.30m below existing ground Level.		SB - Small Bulk Sample				
2. Groundwater was not encountered within the depth of exploration		U - Undisturbed sample				
3. Hole chiselled from 3.50-5.30m in 2hrs		S - Standard Penetration Test				
		LB - Large Bulk Sample				
		W - Water Sample				
		R - Rock Sample				
		V - Shear strength results from vane test				
						Sheet 1 of 1
		Logged by Ebenezer		Checked by Ansah		

Source: Study Team

Figure A7-6 Borehole Log at BH-5

PROJECT:		BOREHOLE No. BH 6					
Proposed Equipment & Methods		Elevation:	Coordinates:				
Picon Wayfarer 1500 light cable percussion rig with standard accessories for sinking 150mm diameter holes.			N E				
CLIENT :		Date Begun: 28/06/2012					
		Date Completed: 28/06/2012					
LOCATION: Osuwem - Asutuare							
Description	Reduced Level (m)	Legend	Depth (Thick) (m)	Samples / Tests			Field Records
				Depth (m)	Sample Type	No. Test	
Soft ,moist, dark brown sandy CLAY			0.30				
Verystiff, moist, dark brown CLAY with traces of sand and gravel			0.50	SB	1		
			1.00 - 1.45	SPT	1	N = 22	5,7,6,6,5,5 1.0
			1.50	SB	2		
Highly weathered yellowish/ greyish brown GNEISS			1.80				
			2.00 - 2.35	SPT	2	N > 50	14,14,7,18,32 2.0
			3.00 - 3.45	SPT	3	N = 35	9,8,10,6,8,11 3.0
			3.35				
END OF PERCUSSION DRILLING							
Remarks: 1. Drill- hole was terminated at a depth of 3.35m below existing ground Level. Encountered rock at 3.35m below the surface. 2. Groundwater was not encountered within the depth of exploration				LEGEND: SB - Small Bulk Sample U - Undisturbed sample S - Standard Penetration Test LB - Large Bulk Sample W - Water Sample R - Rock Sample V - Shear strength results from vane test			
				Logged by Ebenezer		Checked by Ansah	
				Sheet 1 of 1			

Source: Study Team

Figure A7-7 Borehole Log at BH-6

Appendix 8 HDM-4 Input Data

Table A8-1 Road Sections - Basic

HDM-4

ROADWAY DEVELOPMENT & MANAGEMENT

Study Name: 4. Construction of new bypass_ECDP

Run Date: 09-01-2013

ID	Name	Speed Flow Type	Traffic Flow Pattern	Road Class	Climate Zone	Surface Class	Pavement Type	Length (Km)	Width (m)	Shoulder width (m)	Lanes	MT AADT	NMT AADT Year
CC A	CC_A Tema - Accra	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Concrete	JRCP	25.15	7.30	1.00	2	2,485	0 2013
CC B	CC_B Accra - Kumasi	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	243.37	7.40	1.00	2	2,485	0 2013
CC C	CC_C Kumasi - Tamale	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	357.20	8.15	1.00	2	2,485	0 2013
EEC_A	EEC_A Tema - Asu Jot	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	34.28	7.30	1.00	2	8,856	0 2013
EEC B	EEC_B Asu Jot - Asikun	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	48.20	7.30	1.00	2	8,856	0 2013
EEC C	EEC_C Asikun Jot - Fi	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	63.36	7.30	1.00	2	3,664	0 2013
EEC D	EEC_D Fume - Nkwanta	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	167.08	7.30	1.00	2	5,641	0 2013
EEC E	EEC_E Nkwanta - Tama	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	251.86	7.30	1.00	2	1,428	0 2013
PEC	Proposed Eastern Corrid	Wide 2 Lane Road	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	67.20	7.30	2.50	2	8,163	0 2016
R28	R28 Tema - Fume	Two Lane Standard	Free-Flow	Primary or Trunk	Ghana ECDP	Bituminous	AMGB	210.05	7.30	1.00	2	3,692	0 2013

Table A8-2 Road Sections - Condition

Road Sections - Condition



Study Name: 4. Construction of new bypass_ECDP
Run Date: 10-01-2013

Bituminous Sections:		Condition Year	Roughness IRI (m/km)	Total Cracking Area (%)		Potholes (no./km)	Edge Break (m ² /km)	Rut Depth (mm)	Texture Depth (mm)	Skid Resistance (SCRIM SFC50)	Drainage Condition
ID	Name			ACRA	ARV						
EEC_A	EEC_A Tema - Asu Jct.	2012	2.50	1.00	1.00	0.00	0.00	3	3	1	Excellent
EEC_B	EEC_B Asu Jct. - Asiku	2012	4.00	5.00	8.00	5.00	5.00	5	2	1	Excellent
EEC_C	EEC_C Asikuma Jct. - F	2012	2.50	1.00	1.00	0.00	0.00	3	3	1	Excellent
EEC_D	EEC_D Fume - Nkwanta	2012	4.00	5.00	8.00	5.00	5.00	5	2	1	Excellent
EEC_E	EEC_E Nkwanta - Tamu	2012	4.00	5.00	8.00	5.00	5.00	5	2	1	Excellent
R28	R28 Tema - Fume	2012	2.50	1.00	1.00	0.00	0.00	3	3	1	Excellent
CC_B	CC_B Accra - Kumasi	2012	2.50	1.00	1.00	0.00	0.00	3	3	1	Excellent
CC_C	CC_C Kumasi - Tamale	2012	2.50	1.00	1.00	0.00	0.00	3	3	1	Excellent
PEC	Proposed Eastern Corri	2015	2.00	0.00	0.00	0.00	0.00	0	1	1	Excellent

Concrete Sections:		Condition Year	Average Faulting IRI (m/km)	Spalled Joints (%)	Cracked Slabs (%)	Deter Cracks (no./km)	Failures (no./km)	
ID	Name							
CC_A	CC_A Tema - Accra	2008	4.00	2	0.50	1.00	1	0.0

Table A8-3 Vehicle Fleet – Basic

HDM - 4

HDM - 4
HIGHWAY DEVELOPMENT & MANAGEMENT

Vehicle Fleet - Basic

Study Name: 4. Construction of new bypass_ECDP
Run Date: 10-01-2013

Motorised Vehicle Types:

Name	Base Type	PCSE	No. of No. of		Tyre Type	Tyre Base Recaps	Tyre Retread Cost (%)	Annual Km	Annual Work Hours	Avg Life	Private Use (%)	Pass-engers	Work Related Trips (%)	ESALF	Oper. Weight (t)	Life Model
			Wheels	Axles												
6-3_Truck Trailer	Articulated Truck	1.80	18	5	Bias ply	1.30	15.00	85,000	2,050	15	0	0	100.00	4.63	28.00	Optimal
5_Heavy truck	Heavy Truck	1.60	10	3	Bias ply	1.30	15.00	60,000	2,050	15	0	0	100.00	2.28	13.00	Optimal
4-2_Medium Truck	Medium Truck	1.40	6	2	Bias ply	1.30	15.00	40,000	1,200	12	0	0	100.00	1.25	7.50	Optimal
2_Small Bus	Mini Bus	1.20	4	2	Radial ply	1.30	15.00	60,000	750	8	10	10	90.00	0.01	1.50	Optimal
1-1_Car/Taxi	Four Wheel Drive	1.00	4	2	Bias ply	1.30	15.00	23,000	1,300	10	20	3	80.00	0.01	1.80	Optimal
3-2_Large Bus	Heavy Bus	1.60	10	3	Bias ply	1.30	15.00	70,000	1,750	12	10	40	90.00	0.80	10.00	Optimal
7_Others	Articulated Truck	1.80	18	5	Bias ply	1.30	15.00	85,000	2,050	15	0	0	100.00	4.63	28.00	Optimal
1-2_Pick-up	Four Wheel Drive	1.00	4	2	Bias ply	1.30	15.00	23,000	1,300	10	20	3	80.00	0.01	1.80	Optimal
3-1_Medium Bus/Mummy W	Heavy Bus	1.60	10	3	Bias ply	1.30	15.00	70,000	1,750	12	10	40	90.00	0.80	10.00	Optimal
4-1_Light Truck	Medium Truck	1.40	6	2	Bias ply	1.30	15.00	40,000	1,200	12	0	0	100.00	1.25	7.50	Optimal
6-1_Semi - Trailer (Light)	Articulated Truck	1.80	18	5	Bias ply	1.30	15.00	85,000	2,050	15	0	0	100.00	4.63	28.00	Optimal
6-2_Semi - Trailer (Heavy)	Articulated Truck	1.80	18	5	Bias ply	1.30	15.00	85,000	2,050	15	0	0	100.00	4.63	28.00	Optimal

Table A8-4 Vehicle Fleet – Economic

HDM - 4

Highway Development & Management

Study Name: 4. Construction of new bypass_ECDP
Run Date: 10-01-2013
Currency: To be completed

Motorsised Vehicle Types:

Name	Base Type	New Vehicle	Replace Tyre	Fuel (per litre)	Lubr.Oil (per litre)	Maint Labour (per hr)	Crew Wages (per hr)	Annual Overhead	Annual Interest (%)	Passenger Work Time (per hr)	Passenger Non-Work (per hr)	Cargo Holding (per hr)
6-3_Truck Trailer	Articulated Truck	134,344	556	0.55	2.60	1.61	1.09	800	12.00	0.34	0.09	0.50
5_Heavy truck	Heavy Truck	95,487	556	0.55	2.60	1.15	1.09	800	12.00	0.34	0.09	0.30
4-2_Medium Truck	Medium Truck	68,630	215	0.55	2.60	1.15	0.95	700	12.00	0.34	0.09	0.10
2_Small Bus	Mini Bus	30,788	155	0.42	4.15	1.15	0.52	500	12.00	0.34	0.09	0.00
1-1_Car/Taxi	Four Wheel Drive	11,600	120	0.42	4.15	1.84	0.09	400	12.00	0.50	0.13	0.00
3-2_Large Bus	Heavy Bus	61,964	297	0.55	2.60	1.15	0.78	700	12.00	0.34	0.09	0.00
7_Others	Articulated Truck	146,797	608	0.55	2.60	1.61	1.09	800	12.00	0.34	0.09	0.30
1-2_Pick-up	Four Wheel Drive	16,385	312	0.42	4.15	1.84	0.09	400	12.00	0.50	0.13	0.00
3-1_Medium Bus/Mummy W/Heavy Bus	Medium Truck	61,964	297	0.55	2.60	1.15	0.78	700	12.00	0.34	0.09	0.00
4-1_Light Truck	Medium Truck	68,630	215	0.55	2.60	1.15	0.95	700	12.00	0.34	0.09	0.10
6-1_Semi - Trailer (Light)	Articulated Truck	134,344	556	0.55	2.60	1.61	1.09	800	12.00	0.34	0.09	0.50
6-2_Semi - Trailer (Heavy)	Articulated Truck	134,344	556	0.55	2.60	1.61	1.09	800	12.00	0.34	0.09	0.50

Appendix 9 Road Sectors Impact Assessment and Recommended Mitigation Measures in ESMF

APPENDIX 5

Analysis of Environmental / Social Issues Common to Road Sector Activities

	Environmental / Social Parameters	Common								Average	Ranking
		GHA	EPA	DUR	DFR	WD	FS D	WRC	FC		
1	Dust	H	H	H	H	H	H	H	H	H	1
2	Noise	H	H	H	H	M	H	L		H	5
3	Road accidents	M	M	M	M	H	M	-		M	16
4	Public safety	M	M	M	H	M	M	M		M	17
5	Resettlement	M	M	H	L	M	M	H	L	M	21
6	Compensation issues/agreement	M	M	H	M	M	M	H	M	M	11
7	Wildlife concerns	L	L	M	L	M	M	-	M	M	20
8	Forestry concerns (e.g. access)	L	L	H	L	M	M	M	L	M	19
9	Habitat disruption	M	M	H	L	H	M	M	M	M	15
10	Water contamination	H	H	M	M	H	M	H	M	M	14
11	Stream diversion / blocking	M			M	M	M	H	M	M	9
12	Flooding	M	M	M	L	M	M	M	M	M	12
13	Run off	M	M	M	M	M	M	M	M	M	10
14	Induced development	M	M	H	M	M	M	M	H	M	8
15	Cultural concerns	M	M	H	M	M	M	L	L	M	13
16	Archaeological losses	L	L	L	L	M	M	L	L	L	22
17	Pits / trenches near roads	H	H	H	H	H	M	M	M	H	4
18	Inadequate drains along roads	H	H	M	M	H	H	L	M	H	6
19	Road construction waste generation & disposal	H	M	M	H	H	L	H	M	H	7
20	Top soil removal	H	H	H	M	H	H	M	M	H	3
21	Tree & vegetation removal	H	H	H	H	H	M	H	M	H	2
22	Extensive construction (impact) corridor	H	M	H	L	M	-	M	M	M	18

Note: L - Represents Low Occurrence

M - Represents Medium Occurrence

H - Represents High Occurrence

APPENDIX 6

Analysis of Environmental / Social Issues Significant to Road Sector Activities

	Environmental / Social Parameters	Significant								Average	Ranking
		GHA	EPA	DUR	DFR	WD	FS D	WRC	FC		
1	Dust	H	H	H	H	H	H	H	M	H	1
2	Noise	H	H	H	M	M	H	L	M	M	12
3	Road accidents	H	M	M	M	-	M	-	H	M	15
4	Public safety	H	H	H	M	M	M	H	M	H	3
5	Resettlement	H	H	H	M	M	M	H	M	M	8
6	Compensation issues/agreement	H	M	H	M	M	H	H	M	M	9
7	Wildlife concerns	H	M	M	M	M	M	-	M	M	17
8	Forestry concerns (e.g. access)	H	M	M	M	M	M	M	M	M	16
9	Habitat disruption		M	H		H	M	M	M	M	18
10	Water contamination	H	H	H	M	H	H	H	M	H	2
11	Stream diversion / blocking	H	M	M	M	M	H	M	M	M	14
12	Flooding	H	H	M	M	L	H	M	M	M	11
13	Run off	H	L	H	H	M	H	M	H	H	5
14	Induced development	M	M	H	M	M	M	-	M	M	21
15	Cultural concerns	H	H	H	M	M	M	M	M	M	13
16	Archaeological losses	M	M	L	M	H	L	M	M	M	20
17	Pits / trenches near roads	H	H	H	H	H	M	M	L	H	6
18	Inadequate drains along roads	H	H	H	M	H	M	M	M	M	10
19	Road construction waste generation & disposal	M	M	H	H	M	L	M	M	M	19
20	Top soil removal	H	M	H	M	H	M	H	M	M	7
21	Tree & vegetation removal	H	H	H	H	M	M	H	M	H	4
22	Extensive construction (impact) corridor	H	M	H	L	M	-	M	M	M	22

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (1)

No	Impact	Potential Source	Mitigation Measures
1	<p>Soil Impacts</p> <p>Loss of productive soil elimination of the productive capacity of the soil covered by roads particularly where the site for the road development is also suitable for agriculture.</p>	<p>Removal of productive soil Compaction with heavy machinery during construction Burrow pits and gravel winning, Quarries Spoil dumping</p> <p>Site preparation and clearing</p>	<ul style="list-style-type: none"> • Minimizing the area of ground clearance; • Avoiding sensitive alignments, including steep slopes • Progressive replanting of disturbed areas during construction not after • Terracing of nearby marginal farmland to make it more productive on the long term; • Remediation of affected soils by using a sub soils to break up hardpan produced by compaction with heavy equipment;
	<p>Erosion</p>	<p>Removal of vegetation and Soil disturbance coupled with poor drainage</p> <p>Site preparation and clearing</p>	<ul style="list-style-type: none"> • Specifications for contractors responsibilities to cover such issues as erosion control, prevention of fuel spills during construction, and planting as well as timely watering of plantings. • Minimizing the area of ground clearance
	<p>Destabilization of slopes which can lead to landslides</p>	<p>Creation of road cuts or embankments. Excessive steepness of cut slopes, deficiency of drainage, modification of water flows,</p>	<ul style="list-style-type: none"> • Balancing filling and cutting requirements through route choice, so as to avoid/minimize the production of excess spoil material and reduce the need for borrow pits; • Avoiding the creation of cut slopes and embankments of an angle greater than the natural angle of repose for the local soil type; and • Engineering solutions such as intercepting ditches at the tops and bottoms of slopes. Gutters and spillways are used to control the flow of water down a slope; • Terraced or stepped slopes to reduce the steepness of a slope. riprap, or rock material embedded in a slope face, sometimes combined with planting, retaining structures, such as gabions (rectangular wire baskets of rocks), etc should be explored
	<p>Soil contamination during road construction and traffic operations.</p>	<p>Daily traffic operation on very busy roads. Metals from emissions such as chromium, lead, and zinc remain in the soil for hundreds of years. Pollutants settling in roadside soil can impair the growth of vegetation increasing potential for erosion.</p> <p>Spillage of hazardous products in transit.</p> <p>Site preparation and clearing</p>	<ul style="list-style-type: none"> • Enforcement of emission standards and introduction of control legislation and mechanism • Guidelines for transport of hazardous products defining permissible routes • Emergency response procedures for spillage

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (2)

No	Impact	Potential Source	Mitigation Measures
2	<p>Water Resources Impacts</p> <p>Modification of flow of surface waters</p> <p>Ground water table modifications</p> <p>Water quality degradation (surface and groundwater)</p>	<p>Concentrating flows at certain points and, in some cases, increasing the speed of flow resulting in flooding, soil erosion, channel modification, and siltation of streams.</p> <p>- Earthworks Road drainage and excavation & embankments and structures can reduce or raise the water table (through restricting flow)</p> <ul style="list-style-type: none"> • Sedimentation, changes in biological activity in streams and on their banks • Uncontrolled construction activities, • Chemicals spillage • Chronic pollution of surface runoff from exhaust emissions, pavement and tyre wear, petroleum product drippage, and corrosion of metals 	<ul style="list-style-type: none"> • Avoiding alignments which are susceptible to erosion, such as those crossing steep slopes; • Minimize the number of water crossings • Use clean fill materials around watercourses such as quarried rock containing no fine soil; and • Provide reservations/buffer zones of undisturbed vegetation between road sites and water bodies • Introduce Water speed reduction measures e.g. grasses, riprap, and other devices in water channels etc • Provide settling basins to remove silt, pollutants, and debris from road runoff water before discharge to adjoining streams or rivers • Construction of runoff channels, contouring or other means of erosion control • Pave sections of roads prone to erosion and sedimentation particularly relevant near water crossings. • Compensatory measures such as provision of bore holes and wells for communities adversely affected • Adopt environmental enhancements measures in design such as water retention structures in dry areas, and raising inlets to drainage culverts in high water table areas, retarding basins in areas prone to flooding to reduce runoff peaks, spillways

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (3)

No	Impact	Potential Source	Mitigation Measures
3	<p>Air Quality Impacts Dust Emissions such as Nitrogen oxides (NO_x), Hydrocarbons (HC), Carbon monoxide (CO). Sulfur dioxide (SO₂), Particulates including suspended airborne particles from diesel fuel combustion, materials produced by tyre, brake and road wear, and dust, lead (Pb) Aldehydes etc.</p>	<p>Construction-related air pollution Batching plants and asphalt plant operations Material dump sites Vehicular emissions Haulage of materials</p>	<ul style="list-style-type: none"> • Water dousing to minimize dust • Contract specifications include dust control measures • Rerouting traffic away from populated areas and reducing traffic congestion. • Provision of Bypass roads. • Covering of Hauling trucks carrying sand with canvass to avoid dust emission; • Location of material storage areas away from communities and environmentally sensitive receptors • Selecting road alignments which avoids housing, schools, and workplaces; • Avoiding placement of busy intersections, near housing, schools or workplaces; • Taking account of prevailing wind direction when siting roads and road features, including refueling stations, near population centres; • Avoiding steep grades and sharp curves which would promote deceleration, acceleration and shifting wherever possible; • Sealing high-use dirt roads, where they pass through populated areas, to control dust; and • Planting tall, leafy, and dense vegetation between roads and human settlements to filter pollutants • Vehicle emissions standards as well as inspection and maintenance requirements;

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (4)

No	Impact	Potential Source	Mitigation Measures
4	<p>Habitat Destruction and disruption (flora and fauna impacts)</p> <p>Habitat loss</p> <p>Habitat fragmentation</p>	<p>Right of way and land take Road intersecting habitat, Borrow and pits, and quarries</p> <p>When a road cuts through an ecosystem it affects the ecosystem's stability and health. Roads tend to fragment an area into weaker ecological sub-units, thus making the whole more vulnerable to invasions and degradation.</p> <p>Corridor restrictions Accidental death and poaching of animal species.</p> <p>Aquatic habitat damage -Erosion from poorly constructed and rehabilitated sites can lead to downstream siltation, ruining spawning beds for fish.</p> <p>Constriction of flows at water crossings can make the current too fast for some species.</p> <p>Alterations of flood cycles, tidal flows, and water levels can upset trophic dynamics by affecting the life cycle of plankton, and have corresponding effects on the rest of the food chain.</p> <p>Rechanneling of waterways is often undertaken as part of road construction to avoid flooding and make crossing structures simpler. In the process, natural streambeds are dug up and useful obstructions, including large boulders, are removed.</p>	<ul style="list-style-type: none"> • Avoid environmentally sensitive areas to prevent severe impacts on flora and fauna. • Water crossings should be minimized, and buffer zones of undisturbed vegetation should be left between roads and watercourses. • Planting in road rights-of-way and adjacent areas can help to support local flora and fauna. • Re-engineering road cross-section designs by using narrower widths, lower vertical alignments, smaller cuts and fills, flatter side slopes, and less clearing of existing vegetation. • Provision of animal crossings to facilitate movements • Fencing or plant barriers can reduce the risk of collisions between animals and vehicles. • Provision of aquatic crossings: Culverted crossings should be designed with the needs of migratory aquatic species in mind. • Baffles might be installed to slow the flow enough to allow fish movement etc • Traffic control measures- speed limits, particularly at night and in areas of frequent animal crossing, warning signs • Roadside reflectors to scare animals away from the roadway when vehicles approach at night.

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (5)

No	Impact	Potential Source	Mitigation Measures
5	<p>Noise and Vibration</p> <p>Degradation of human welfare and hearing impairment, communication problems and leading to elevated stress levels as well as associated behavioural and health effects.</p> <p>Causing auditory fatigue, temporary and permanent loss of hearing ability, sleep disorders, and can even contribute to learning problems in children.</p> <p>Damage to roadside structures particularly makeshift or lightly constructed buildings through vibration</p> <p>Disruption of wildlife habitat and movement</p>	<p>Vehicular movement - friction between vehicle and the road surface;</p> <p>Driver behaviour- using vehicles' horns, playing loud music, shouting at each other, and causing their tyres to squeal as a result of sudden braking or acceleration.</p> <p>Construction and maintenance activities</p> <p>Asphalt plant operations</p> <p>Resonance of traffic</p> <p>Piling for interchange construction and bridges</p>	<ul style="list-style-type: none"> • Surface design and maintenance • Application of a bituminous surface layer over worn concrete roadways is effective in reducing frictional noise. • Use open-graded asphalt • Smooth, well-maintained surfaces such as freshly laid asphalt without grooves and cracks will keep noise to a minimum. • Road design should avoid steep grades and sharp corners to reduce noise resulting from acceleration, braking, gear changes, and the use of engine brakes by heavy trucks at critical locations. • Provision of Noise barriers – concrete, earth, metal, window glazing etc. • Environmental specifications for contractors - In carrying out construction, quarrying, or other such activities in noise-sensitive areas, special attention may have to be paid to equipment noise standards, hours of operation, material haulage routes, and other aspects of work-site management.
6	<p>Landscape Alteration and aesthetics</p>	<p>Lack of harmony between the road and Landscape features such as natural relief and morphology, hydrology, vegetation, recreational areas, cultural heritage sites.</p> <p>Quarrying, Borrow pits and gravel winning associated with road construction</p>	<ul style="list-style-type: none"> • Reforestation • Landscaping of route • Selection of alignment characteristics that best fit the route into the landscape e.g. Vertical and horizontal alignment should follow the natural relief • Reclamation of degraded lands

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (6)

No	Impact	Potential Source	Mitigation Measures
7.	<p>Impact on communities and economic activities</p> <p>Splitting of Communities</p> <p>Loss/disruption of roadside community business and social activity</p> <p>Increased land and property values leading to higher rental values, a turnover in occupancy, and displacement of lower-income tenants</p>	<p>Both new roads and reconstruction requiring widening can split a community.</p> <p>Introduction of faster traffic, access controls, and median barriers generally cuts traditional lines of travel or communication in communities</p> <p>Provision of longer alternative routes for local movements affects businesses and pedestrian movements</p> <p>Disruption of links between villagers and their farmlands by a new road or increased traffic.</p> <p>Roadside business activities including the selling of goods, small businesses such as cafes and vehicle, repair shops; bus or taxi stops can be disrupted by road const.</p> <p>Added to this list of activities are social activities associated with the roadside . In rural areas, in particular, but also in urban areas and at entrances to towns and villages, the roadside provides a social disruption</p> <p>People congregate along the roads to talk, smoke, drink or watch the traffic</p> <p>Increased traffic flows as a result of road improvements can increase conflicts between local activities and the efficiency and safety of traffic functions of the road.</p> <p>Further conflicts and safety concerns arise when road improvement plans call for widening the road and reducing encroachments and accesses.</p> <p>Creation of by pass roads Although by-pass roads can reduce conflict between road use and community welfare, they also can lead to loss of business and death of communities</p> <p>increased by infrastructural improvements, new roads, road improvements</p> <p>Creation of diversion routes</p>	<ul style="list-style-type: none"> • Resettlement and compensation may need to be considered for those whose housing, land; welfare or livelihood is directly affected by a project. • Take account of local movements in road design stage • Make provision for improved crossings or alternative access routes. • Provision of alternative space for displaced activities and service areas adjacent to the new routes for displaced businesses • Planning of temporary traffic diversions,

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (7)

No	Impact	Potential Source	Mitigation Measures
8	<p>Impacts from land acquisition and resettlement</p> <p>displacement of communities loss of business, properties and incomes social stress economic loss, social and psychological disruption for the affected individuals and their families.</p>	<p>Compulsory land acquisition (expropriation of properties for public projects).</p> <p>Demolishing of structures such as houses, buildings, shops</p>	<ul style="list-style-type: none"> • Impacts on roadside land users can be avoided by choosing route locations away from built-up areas and by restricting the extent of road • Works to avoid interference with existing activities. • Adoption of a reduced speed design, reduced right-of-way land • Requirements, or design changes (underground drainage, for instance) can avoid impacts on properties and activities. • Compensation of owners of the land and properties on the basis of the current market rates • Resettlement of affected persons where possible
9	<p>Impact on Cultural Heritage</p> <p>Damage could affect the historic, scientific, social, and amenity values; aesthetic impacts on cultural monuments and archaeological sites;</p>	<p>Damage caused by road construction, related works such as quarries and borrow sites, and unregulated access to cultural heritage sites.</p>	<ul style="list-style-type: none"> • Road construction should avoid any alignment that cuts through known cultural sites • Cultural sites uncovered during road works should lead to possible realignment of the road. • In some unusual cases it is preferable to leave a cultural site buried beneath the road. • Excavation, erosion control, restoration of structural elements, rerouting of traffic, and site mapping. • Salvage excavation and relocating artifacts or ruins from a site. • Dialogue between the road department and Monuments and Museums board is required to avoid damage to cultural sites • Marking and fencing important cultural sites during the construction period
10	<p>Waste Generation</p>	<p>Excavation spoils Inappropriate Construction camp design and mismanagement leading to sewage and garbage pollution; Spills from construction equipment operation and servicing. Construction waste Waste asphalt</p>	<ul style="list-style-type: none"> • Disposal of construction related waste materials at designated waste dump site • Waste minimization measures • Waste management plan to be incorporated in road planning
11	<p>Traffic Disruptions and interruption of local traffic</p>	<p>Carelessly planned detours and road closures.</p>	<ul style="list-style-type: none"> • Provision of planned diversion routes during construction • Use of signboards and other public information mechanisms to inform public in advance of construction work and schedule

APPENDIX 8

Summary of Potential Environment and Social Impacts Associated with Road Transport Sector and Mitigation Measures (8)

No	Impact	Potential Source	Mitigation Measures
12	Utility Disruptions	Construction activities and the need to realign utility supply lines	<ul style="list-style-type: none"> • Advance public notices • Collaboration with utility providers • Provision of alternative supplies where applicable e.g. water supply by tankers to affected communities • Restoration of utility lines and other structures damaged during the construction
13	Public Safety and Health	<p>Exposure to atmospheric emissions from construction equipment</p> <p>Exposure to excessive and continuous noise and vibration from construction activities</p> <p>Lack of warning sign and safeguards</p> <p>Influx of migrant workers and introduction of diseases such as STDs</p>	<ul style="list-style-type: none"> • Servicing of construction equipment • Use of equipment with low operating noise levels • Restricting construction works to day time hours • Introduction of traffic/speed control devices • Intensive public awareness campaigns • Provision of signboards • Provision of Diversions where possible during construction period • open ditches and other potential hazards to be properly marked with visible tapes
14	Occupational Health and Safety	Accidents from operation of construction equipment	<ul style="list-style-type: none"> • Training of workers in equipment use • Provision of personal protective equipment and clothing • Enforcement of the use of such equipment • Frequent maintenance of equipment • Safety rules for workers and their enforcement • Emergency procedures and training

Appendix 10 Requirement of JICA Guideline (Appendix 1 of JICA Guideline)

Appendix 1. Environmental and Social Considerations Required for Intended Projects

In principle, appropriate environmental and social considerations are undertaken, according to the nature of the project, based on the following:

1. Underlying Principles

1. Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.
2. Such examinations must be endeavored to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis; these must be conducted in close harmony with the economic, financial, institutional, social, and technical analyses of projects.
3. The findings of the examination of environmental and social considerations must include alternatives and mitigation measures, and must be recorded as separate documents or as a part of other documents. EIA reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impacts.
4. For projects that have a particularly high potential for adverse impacts or that are highly contentious, a committee of experts may be formed so that JICA may seek their opinions, in order to increase accountability.

2. Examination of Measures

1. Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided by any of the aforementioned measures.
2. Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; the costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impacts must be accompanied by detailed environmental management plans.

3. Scope of Impacts to Be Assessed

1. The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale

impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety.

2. In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project.

4. Compliance with Laws, Standards, and Plans

1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social consideration policies and plans of the governments that have such jurisdiction.

2. Projects must, in principle, be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such areas). Projects are also not to impose significant adverse impacts on designated conservation areas.

5. Social Acceptability

1. Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.

2. Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all members of which are susceptible to environmental and social impacts and may have little access to decision-making processes within society.

6. Ecosystem and Biota

1. Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests.

2. Illegal logging of forests must be avoided. Project proponents etc. are encouraged to obtain certification by forest certification systems as a way to ensure the prevention of illegal logging.

7. Involuntary Resettlement

1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.

2. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc. in a timely manner. Prior compensation, at full replacement cost, must be provided as much as possible. Host countries must make efforts to enable people affected by projects and to improve their standard of living, income opportunities, and production levels, or at least to restore these to pre-project levels.

Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting means for an alternative sustainable livelihood, and providing the expenses necessary for the relocation and re-establishment of communities at resettlement sites.

3. Appropriate participation by affected people and their communities must be promoted in the planning, implementation, and monitoring of resettlement action plans and measures to prevent the loss of their means of livelihood. In addition, appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

4. For projects that will result in large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.

8. Indigenous Peoples

1. Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.

2. When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the consent of indigenous peoples in a process of free, prior, and informed consultation.

3. Measures for the affected indigenous peoples must be prepared as an indigenous peoples plan (which may constitute a part of other documents for environmental and social consideration) and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the indigenous peoples plan, consultations must be made with the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, it is desirable that explanations be given in a form, manner, and language that are understandable to the people concerned. It is desirable that the indigenous peoples plan include the elements laid out in the World Bank Safeguard Policy, OP4.10, Annex B.

8. Monitoring

1. After projects begin, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. They then take appropriate measures based on the results of such monitoring.
2. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents etc. must ensure that project plans include feasible monitoring plans.
3. Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.
4. When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.

Appendix 11 Baseline of Natural and Social Environment in the Study Area

11.1 Project Area of Influence

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

The project road traverses three districts, namely Dangme West in the Greater Accra Region, North Tongu in the Volta Region and Asuogyaman in the Eastern Region. The main townships along the road include Osuwem, Asutsuare, Dufor Adidome, and Asikuma

(2) Upgrading of Asutsuare – Aveyime Road

The project road traverses two districts, namely Dangme West and Asuogyaman in the Eastern Region. There are three main townships at the both end of the target road, Asutsuare and Aveyime, and Volivo at the middle.

Table A11-1 Main Towns in Proposed Project Area

Region	District	District Capital	Main Townships on Road
Greater Accra	Dangme West	Dodowa	Osuwem, Asutsuare, Volivo,
Eastern	Asuogyaman	Atimpoku	Asikuma
Volta	North Tongu	Adidome	Dufor Adidome, Aveyime

Source: Study Team

(3) Overview of Land Use and Livelihoods

In general along the proposed road projects, the land use along the existing roads proposed alignments are:

- Food crop farms, mainly cassava and rice
- Cash crop farms, mainly oil palm, mango, woodlots, and banana plantations
- Cattle grazing fields (mostly north of the Volta River between Dufor Adidome and Asikuma Jct.)
- Natural or original vegetation

Other livelihoods specifically related to the Volta River are:

- Aquaculture in the Volta River (limited but popular)
- Shell mining as a raw materials for white paint or as a construction materials
- Canoe ferries offering transport services

11.2 Profiles of Potentially Affected Districts

(1) Dangme West District

a) Climate

The Dangbe West part of the southeast coastal plain of Ghana, which encompasses the project area, is one of the hottest and driest parts of the country. Temperatures are high for most of the year, being the highest during the main dry season (November – March) and the lowest during the short dry season (July – August). The absolute maximum temperature is 40°C.

Rainfall is generally very low, with most of it being very erratic in nature and falling between September and November. Mean annual rainfall increases from 762.5 mm on the coast to 1,220 mm.



Photo A11-1 Land scape around grazing field



Photo A11-2 Aquaculture pond



Photo A11-3 Shell mining and baking



Photo A11-4 Canoe ferry

Photos by the Study Team, May 2012

b) Topography, Geology and Soil

In the central portion of the Accra plain, the relief is gentle and undulating, with heights not exceeding 70 m. The plains are punctuated by a few prominent inselbergs, isolated hills, outliers and knolls scattered over the area. Prominent relief features include the Yongua inselberg (427 m) which has a conical shape with a number of outliers around Asutsuare and Osuwem areas; the Krabote inselberg also to the North, and the Shai Hills (289 m) towards the western part of the area. There are conspicuous large rock outcrops and boulders in the vicinity of the hills in some places.

The soils in the area are poorly drained pale-coloured sandy silty and clay soils formed recently or contemporary Volta Alluvium. The soils appear to be moderately well supplied with nutrients under natural conditions and are easily workable even with simple implements. In the recent past most of it was under sugarcane cultivation to feed the now collapsed Asutsuare Sugar complex. The same fields are currently under extensive rice cultivation, making the flood plain soils one of the most fertile soils in the area. Recent alluvium occupies the Volta flood plain and the valleys of the major streams on the plain. There are no known mineral deposits of commercial and economic value in the area, except for oyster shell deposits at Volivo and its surroundings and clays of various types.

c) Land Use

Although the soils in the district have relatively low fertility and remain dry for most of the year due to the unreliable and insufficient rainfall, there is still enormous potential for the

development and expansion of agriculture. Extensive irrigation of the low plains with water drawn from the Volta River would enable these soils to support extensive rice, maize and vegetable cultivation. At present, the area is widely used for the cultivation of rice, sugarcane and vegetables.

d) Water Resources and Drainage

Flowing over fairly low terrain, most of the streams have carved wide valleys, which are dry for most of the year. The very seasonal nature of most of the streams caused by high temperatures and equally high insolation levels has encouraged the construction of a number of artificial dams and ponds of varying size, which are used for irrigation and for watering of livestock.

The project area forms part of the lower Volta flood plain. The repeated process of flooding and recession of the Volta waters over the years has created fertile alluvial soil, a vast sedimentary strata of oyster shells and a number of inland lakes. Ground water potential in the area is quite low and saline.

Sources of water for domestic use are pipe borne, boreholes, streams and wells. Except for the towns, most of the villages depend on borehole water, hand-dug well water, streams and rivers.

e) Economic Activities

The area is largely rural. The predominance of the rural population is reflected in the occupational distribution, with agriculture being the main occupation. The relocation of the Golden Exotic Estate (a 3,000-ha banana plantation of which almost 800-ha have been planted) and Tropo Farms, a 5-ha fish farm has, broken new ground in agriculture. Fishing, which could be another big employer given the presence of the Volta River, employs only 6.4% of the people. The area is noted for the production of fruits such as mangoes, pineapple, and banana. In addition, rice production and aquaculture (tilapia) are practised in the Asutsuare area. The area is also noted for animal production with cattle, goats and poultry rearing being the leading activities.

f) Social Infrastructure

The district has about 252 km of roads, of which 40% is paved and the rest are feeder roads. Tracks and footpaths also link villages. The total road network appears to have a good spatial distribution compared to other districts. The 14.8-km railway line from Tema through Afienea to the Shai Hills is not being used. Out of the 231 settlements in the district, about 30% are connected to the national electricity grid. Major towns in the district including Dodowa, Prampram, Asutsuare, Dawhenya, Afienea, Dorymu, Old Ningo, Kordiabe, New Ningo and Agomeda have electricity. An estimated 34% of the inhabitants in the 231 settlements in the district have no access to potable water. A total of 18 towns have access to piped water, with the remaining towns depending on wells, boreholes and other sources.

g) NGOs

There are many NGOs such as World Vision operating in the district. These NGOs are

involved in projects such as community water supply, food security, capacity building and HIV/AIDS intervention activities.

(2) North Tongu

a) Climate

The climate of the North Tongu District is tropical, greatly influenced by the south-west monsoons from the south Atlantic and the dry Harmattan winds from the Sahara. There are two rainy seasons, the major one from mid-April to early July and the minor one from September to November. The average annual rainfall varies from 900 mm to 1,100 mm with more than 50% of it falling in the major season.

Temperature and relative humidity vary little throughout the year. The mean temperature is 27°C, ranging from a maximum of 33°C and to a minimum of 22°C. Average relative humidity is about 80%, making the weather quite conducive to human activities, such as habitation, farming and recreation.

b) Topography, Geology and Soil

North Tongu is dominantly medium to moderately coarse textured alluvial soils along the Volta River. Below these are the heavier clay soils that characterise most parts of the area, leading to poor surface and sub-surface drainage, making road development difficult. These soils are also very difficult to cultivate because they have low water holding capacity. They are also shallow (low effective rooting depth). They are, however, suitable for rice and sugarcane cultivation under irrigation. They also provide the raw material for the pottery, brick and tile industries. The main mineral deposits in the area are clay, oyster shells, feldspar, nepheline gneiss, sand and granite.

c) Land Use

The project road traverses a number of farming villages and towns. The main form of land use in the project area is agriculture. The land is mainly used for the cultivation of food crops and cattle rearing.

d) Water Resources and Drainage

The area is drained by the Alabo, Kolo, Aklakpa, Gblor, and Nyifla rivers and their numerous tributaries into the Volta River. In the rainy season, these streams overflow their banks, causing damage to roads and farms. There are several ponds and dugouts/dams in the area, which serve as main sources of water supply for the inhabitants and livestock.

The same as in Dangme West District, sources of water for domestic use are pipe borne, boreholes, streams and wells. Except for the towns, most of the villages depend on borehole water, hand-dug well water, streams and rivers.

e) Economic Activities

The leading sector of the district's economy is agriculture. The sector is dominated by small-scale unorganised farmers who depend mainly on labour-intensive production techniques. The sector is characterised by low production resulting from the continuous usage of indigenous farm implements, adoption of indigenous farming practices and a higher level of post-harvest

losses particularly in maize and vegetable production. Fishing, which is done mostly in the Volta River, has declined considerably due to the construction of the Kpong Dam. Traditional fishing communities (Bakpa, Mafi, Mepe, Battor and Volo) close to the Volta River have had their economic base eroded. Livestock breeding is an integral part of the farming communities, with about 30% of the farmers in the district keeping some ruminants. The district is one of the largest cattle breeding areas in the country.

f) Social Infrastructure

The road network in the district is in a poor state, although efforts are being made to improve the roads and make them more motorable. A number of roads and bridges are currently undergoing construction or rehabilitation, and when completed they will make the district generally more accessible.

Until 1994, most communities in the North Tongu District had no access to potable water. The inception of the DANIDA brought a tremendous change in the water supply situation in the district. The DANIDA water project provided piped water to Tedeafenui and other communities in the Adidome area. In addition, 26 communities have been provided with a total of 89 shallow wells fitted with hand pumps. The Volta River provides an important source of water supply to the towns and villages, located along it.

The current supply of hydroelectric power is limited to Adidome, Akyemfo, Battor, Mepe, Mafi-Kumase-Asiekpe and Juapong. Electricity supply is being extended to most of the major settlements in the district. Extension of electric power to towns and villages outside the district capital is dependent on community self-help with the support of the rural electrification programme. Wood fuel and charcoal are the main sources of energy for cooking.

The district has 35 kindergartens, 126 primary schools, 71 junior high schools, five senior high schools and a special school for rehabilitation of the mentally retarded. There is also a farm institute at Adidome, which trains youths in self-employable agricultural skills.

g) NGOs

The same as in Dangme West District, there are many NGOs operating in the district. These NGOs are mainly involved in community water supply, food security, capacity building and HIV/AIDS intervention activities.

(3) Asuogyaman District

a) Climate

This part of the project area in the Asuogyaman District lies within the dry equatorial climate zone and experiences substantial precipitation. It has a long rainy season which starts in April, peaks in June/July and ends in November. The dry season starts in November/December and ends in March.

The annual rainfall is between 67 mm and 1,130 mm and the maximum temperature is 37.2°C, The relative humidity is generally high, ranging from 98% in June to 31% in January.

b) Topography, Geology and Soil

The main rock types of the Asuogyaman District are quartzite acidic gneiss and schist. There

are several out-crops of rocks in the area. In the low-lying areas along Lake Volta, the soil types are Savannah Greisol and Aluviosols. These are hydro-morphine soils confined to the large depression and valley bottoms of the Volta River plain.

The soil is a greyish, dark red in colour. It is mainly impervious and moderately supplied with nutrients. Because of its structure, the soil is liable to temporary flooding in times of high water level. Its nutrient status is moderate but fertiliser is required to ensure sustained yields of crops.

c) Land Use

The project road traverses a number of farming villages and towns in this district and the main form of land use is agriculture (crop farming and animal husbandry). The land is mainly used for cultivation of food crops and cattle rearing.

d) Water Resources and Drainage

The water resources are Lake Volta and the downstream side of the Akosombo Hydroelectric Dam. The same as in other districts, sources of water for domestic use are pipe borne, boreholes, streams and wells. Except for the towns, most of the villages depend on borehole water, hand-dug well water, streams and rivers.

e) Economic Activities

Agriculture is the major economic activity in the district in terms of employment and rural income generation. Crop farming is predominant, with maize, cassava, plantain, vegetables and yam being the major crops. Fishing in Lake Volta is an important economic activity along the 141 km shoreline. It is carried out in wooden planked canoes, with tilapia and chrytrissa (one-mouth thousand) being popular catches. Live box aquaculture of tilapia is also being developed on Lake Volta. The fish are processed mostly by smoking and frying and sent to market centres at Dzeneni, Akosombo, Atimpoku and Agormanya.

There are three main types of farming activities in the district: livestock breeding, food cropping and cash cropping among which food cropping accounts for more than 78% of the farmers in the district (population and housing census in the year 2000). Livestock breeding is carried out on a limited scale, employing only about 8% of farmers, while cash cropping also employs just 12% of the farming population.

f) Social Infrastructure

The Ghana Water Company supplies piped water to towns and villages along the major trunk road and the Volta River Authority supplies water to Akosombo. Other towns and villages depend on deep wells, hand-dug wells and streams.

The district has 28 junior high schools and 7 senior high schools. The teacher/pupil ratio for primary school and junior high school is 1:32 and 1:19 respectively, which are lower than the national average.

The National Health Insurance Scheme (NHIS) began in 2004 and has since registered a total of 31,320 people. Service providers include two hospitals and 13 health centres.

g) NGOs

The same as in Dangme West District, there are many NGOs operating in the district. These

NGOs are mainly involved in community water supply, food security, capacity building and HIV/AIDS intervention activities.

11.3 Water Quality

Water sampling and analysis was conducted. The results of analyzing physical, chemical and bacteriological parameters of surface water (Volta River) are presented in Table A11-2 alongside EPA guideline values. There are no indicators exceeding the EPA guideline values.

Table A11-2 Water Quality of Volta River Surface Water (Mean Concentrations)

Parameter	EPA Method No.	Unit	Sample/Volta River Water	EPA Guideline
Temperature	-	°C	28.6	
Turbidity	3	NTU	10.0	75.0
Colour (apparent)	2	Hz	10.0	100
pH	4	pH Units	6.88	6.0-9.0
Conductivity	1	µS/cm	66.0	1,500
Tot. Susp. Solids (T-SS)	5	mg/l	4.00	50.0
Tot. Dis. Solids (TDS)	6	Mg/l	43.6	1,000
BOD	30	Mg/l	1.64	50.0
COD	29	Mg/l	19.3	250
Sulphate (SO ₄)	19	Mg/l	3.80	250
Phosphate (PO ₄ -P)	17	Mg/l	0.692	2.00
Nitrate (NO ₃ -N)	15	Mg/l	0.119	50.0
Ammonia (NH ₃ -N)	13	Mg/l	0.871	1.00
Salinity	-	ppt	0.041	-
Oil & Grease	-	mg/l	<1.00	10.0

Source: EPA Wastewater Quality Guidelines and Study Team

11.4 Air and Noise Quality

(1) Air Quality

In accordance with sampling methods for the EPA Ambient Air Quality Guidelines, air quality sampling was conducted at representative locations of the two proposed projects. The results shows that at present, all sampling locations are below the EAP guide line for residential areas.

Table A11-3 Results of Ambient Particulate Matter Monitoring

Sample Location	GPS Coordinates	PM ₁₀ (µg/m ³)	TSP(µg/m ³)
Adebosu	N - 06° 24' 14.1", E- 000° 11' 53.1"	18.5	39.7
Amesinyekope	N - 06° 22' 54.3", E- 000° 12' 53.7"	30.1	63.2
Dafor Akpatanu	N - 06° 06' 20.9", E- 000° 15' 54.9"	22.3	50.2
Adakope	N - 06° 03' 07.7", E- 000° 17' 41.3"	40.8	70.3
Osuwem	N-06° 01' 35.4", E- 000° 10' 58.4"	55.7	73.4
Aveyime	N06° 01' 30.7", E000° 22' 02.15"	58.2	83.3
EPA Ambient Air Quality Guidelines for Residential Areas		70 µg/m³	150µg/m³

Instrument Used: Minivol samplers

Source: Study Team



Photos by the Study Team, August 2012

(2) Noise Quality

In general, the noise levels recorded at the various locations along the projects were low. The project roads are all located in mostly rural settings where there is no industrial activity and the traffic volumes is low, and so the noise levels are also low. The ambient noise levels monitored for selected communities are listed in Table A11-4.

Table A11-4 Ambient Noise Levels at Selected Locations

Location	GPS Coordinates	Leq	Lmax	Lmin	L90
Adabosu	N - 06° 24' 14.1", E- 000° 11' 53.1"	48.9	66.4	42.9	45.3
Amesinyekope	N - 06° 22' 54.3", E- 000° 12' 53.7"	66.3	94.4	52.3	55.3
Dafor Akpatanu	N - 06° 06' 20.9", E- 000° 15' 54.9"	45.2	52.6	44.4	48.5
Adakope	N - 06° 03' 07.7", E- 000° 17' 41.3"	56.6	71.9	42.8	50.1
Osuwem	N-06° 01' 35.4", E- 000° 10' 58.4"	64.7	73.7	54.9	57.4
Aveyime	N06° 01' 30.7", E000° 22' 02.15"	69.3	108	59.3	62.8
EPA Daytime Recommended Level for Residential Areas dB(A)		55	–	–	–

Note: Instruments used - Quest Suite Professional, Sound Level Metre, type1900

Source: Study Team



Photos by the Study Team, August 2012

11.5 Flora and Fauna

(1) Flora

The predominant type of vegetation found in this southern part is short savannah grass interspersed with shrubs and short trees, which are characteristic of the Sub- Sahelin type. A large portion of vegetation remains dry for most of the year particularly towards the south except for the short rainy season. In the Volta flood plain areas, tall swampy grass and tall savannah grass with isolated thickets and trees are the main types of vegetation.

The northern area lies within the tropical savannah grassland zone. The vegetation is dense along the Volta River and along the stream basins, and is mainly mangoes, oil palms, baobab, silk cotton, acacia, etc. Farther from the river the vegetation is sparse, predominantly grassland, interspersed with Neem trees and guinea grass, digitaria decumbent and fan palms. The shrub and grassland areas are suitable grounds for cattle breeding, making the area one of the largest cattle-producing areas in the country.



Photo A11-9 Typical vegetation in the proposed project area



Photo A11-10 Typical vegetation in the proposed project area

Photos by the Study Team, August 2012

(2) Fauna

Harvesting of trees for lime and charcoal production in the area and also poaching has caused wildlife, which included elephants, antelopes, monkeys hogs to flee to other reserves close to the Study Area (Figure A11-1). Partridges are, however, still common in the area.



Photo A11-11 Partridges

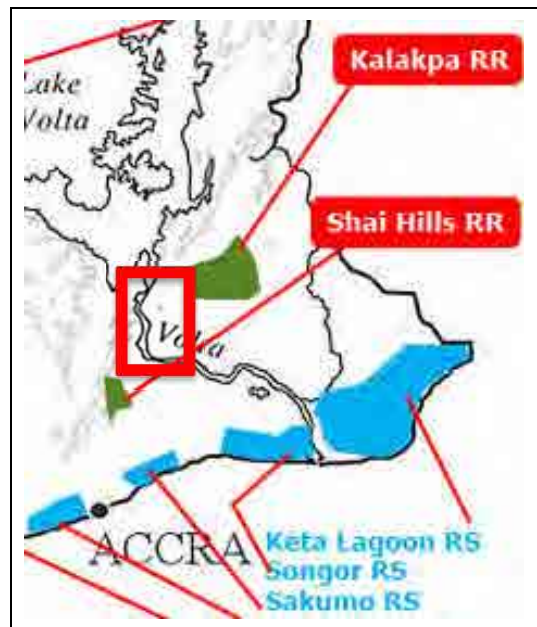


Photo A11-12 Partridges

Photos by the Study Team, August 2012

11.6 Environmentally Sensitive Area around the Proposed Project Area

Details of environmentally sensitive area around the proposed project area are described in the Main Report Section 11.2.2 (6 Environmentally Sensitive Area around Proposed Project Area).



Source: Ghana Wildlife Division

<<http://www.wildlifeghana.com/wildlifeMain/map.html>>

Figure A11-1 Protected Wildlife Areas around Proposed Project Area

Appendix 12 Result of Environmental and Social Environmental Survey

The potential impacts of and appropriate mitigation measures for the projects have been confirmed with reference to similar projects throughout Ghana, and the particular concerns of the local communities have been investigated.

From baseline information gathered at the fieldwork phase and issues that transpired during consultations with stakeholders, the impacts of the projects, particularly during the construction phase, will be as follows:

- Water resources
- Soil erosion and sedimentation
- Air quality
- Noise and vibration
- Expropriation of farmland and forest reserves
- Establishment of borrow pits
- Flora and fauna
- Construction waste
- Construction camps
- Employment and income
- Gender issues
- Traffic safety, accidents and convenience
- Vehicle operating costs and transportation costs

12.1 Potential Positive Impacts

(1) Regional Economy

Construction or upgrading of roads is expected to provide socio-economic benefits to the nation as well as sub-region. The new road between Asutsuare Jct. and Asikuma Jct. will form a major link to parts of the Eastern Corridor. Thus, construction of new road between Asutsuare Jct. and Asikuma Jct. and upgrading of Asutsuare – Aveyime road will have positive impacts on the regional economy, by enhancing accessibility and commercial activities, and facilitating regional economic integration. Although construction activities on the Asutsuare – Aveyime road will cause temporary delays to public and private transport, access to services and facilities should be improved in the long-term through greater reliability and, possibly increased availability of public transport.

Public and private transport opportunities should improve because of faster travel speeds, reduced frequency of breakdowns, and lower maintenance costs. This may encourage an increase in taxi and bus services. Increased growth in the size and number of settlements along the road will speed up deliveries and the availability of transport services.

Construction and upgrading of the road will also improve access to health care and other social services and strengthen local economies.

Demand for goods is expected to increase, and many more people will engage in various economic activities. In the long term, the projects will help reduce poverty in the Study Area. Thus, the impact on the regional and national economies is positive and significant.

(2) Traffic Safety, Accidents and Convenience

Reconstruction of culverts and side drains to reduce flooding of the road will be a component of upgrading the Asutsuare – Aveyime road. The project will improve horizontal and vertical alignment together with improvement of intersection that will significantly improve traffic safety and comfort for road users. As a consequence of the traffic safety measures and improvements of the road, the number of accidents is expected not to increase.

The construction of the new road between Asutsuare Jct. and Asikuma Jct. will ease traffic congestion at townships along the existing N2, particularly Kpong and Atimpoku, and hence the conflicts vehicles and pedestrians and its associated accidents in these areas will be reduced.

Construction of the road will confer additional benefits and convenience including improved access to markets, increased government services such as the provision of electricity, potable water, health services, education and stimulation of agro-industries, especially in the Asutsuare and Aveyime areas.

(3) Vehicle Operating Costs and Transportation Costs

The project has the potential to benefit road users through reduced vehicle maintenance costs and delays. It will benefit the people in the area through increased opportunities and reduced costs of transporting agricultural produce to distribution centres or sale points; sending children to school; getting to other facilities or service centres and encouraging migrant workers to return home more frequently. The effect on overall vehicle operating costs is positive and significant for the local and regional users in the operation phase.

(4) Employment and Income

The projects will lead to an overall upgrading of the socioeconomic setting in the area. In the short-term, recruitment of labour from roadside villages will contribute towards raised employment, increased income and upgrading of the skills of local residents and their families. Newly skilled workers will have enhanced prospects for future employment. The presence of a labour force in the vicinity of settlements will also increase economic and employment opportunities for residents. In the long term, an increase in traffic volume may stimulate business opportunities along the road through the sale of goods and other services. Since the economy of the settlements along the road is largely based on agriculture, road construction may increase transport opportunities and potentially decrease the costs of distributing agricultural products and thereby increase earning potential.

The major economic activity of the inhabitants in the project area is agricultural production and marketing. The improved road will open up the possibilities for agro-business. New industries tend to locate where land is available and infrastructure exists; road corridors are logical choices. Incomes earned directly or indirectly will raise the standard of living of the people involved in the projects.

The impact on employment and income is considered to be significant and positive in the construction phase and slightly positive when the road is in operation.

(5) Gender Issues

The road project will bring new job opportunities for women and also improve their situation within the agriculture and trading sectors. The influx of labour will temporarily cause a significant increase in the demand for vegetables and other foodstuff traditionally produced by women. Catering and trading opportunities will also increase.

The indirect benefits include improved access to health facilities and schools for children. The transport of people and products between the fields and the villages will become faster and safer with the improved road. The women will benefit greatly from the savings in time.

It is anticipated that improvement in the transportation sector, which supports the marketing of agricultural produce, would help increase income levels and the general well-being of women in the districts. Improvement of the road is therefore critical to the livelihood of women in the districts.

(6) Air Quality Improvement

Upgrading of the Asutsuare – Aveyime road will result in improved air quality during the operational life of the road. The paved surfaces will generate much less dust than the present gravel roads, reducing the current negative effect on the flora and crops along the road as well as the health of those people living in the area. The consumption of fuel and thus the amount of exhaust fumes produced per tonnage kilometre will be reduced as the road standard is improved. The post-construction impact on air quality is therefore positive.

Construction of road between Asutsuare Jct. and Asikuma Jct. which will be far from most communities, will reduce the exhaust fumes on the existing N2 because traffic diversion will reduce the number of vehicles on it.

12.2 Potential Negative Impacts

(1) Pollution of Water Resources

Road construction alters the hydrology of watersheds through changes in water quantity and quality, stream channel morphology, and ground water levels. Some culverts over streams and a bridge across the Volta River are to be constructed; as a result, pollution and siltation of the watercourses under these culverts and bridge could occur. If construction takes place during the dry season, the silt banks that are close to the place of work may obstruct the flow if proper de-silting is not carried out. If works are done during the rainy season, a high concentration of suspended matter will occur in the water body concerned. For works that will be done during the rainy season, suspended matter will be carried further with the flow and eventually end up in downstream reservoirs. Soil and water contamination by oil, grease, fuel and paint from equipment yards is likely to occur during the construction phase.

Vegetation cover will be removed from not only the road alignment but also from borrow pits and the fine materials of exposed surfaces would be susceptible to erosion by intense tropical

rainstorms and winds. The creation of stagnant water bodies in borrow pits, quarries, etc. during construction of the road will create conditions suitable for mosquito breeding and other vectors. The impact is negative and significant. Mitigation measures are thus required.

In addition, discharge of wastewater from construction camps will contribute to pollution of nearby rivers. Surface run-off from construction sites and camps may include but not necessarily be limited to hydrocarbons such as waste oil and lubricants. Decreased water quality, through sedimentation or pollution, may have downstream impacts on aquatic fauna (which are important for purifying water), agriculture and other socio-economic uses, such as washing and drinking by rural inhabitants.

The largest impact on present water quality is expected where the project road crosses water bodies. The impact on water quality is considered to be negative and significant in the construction phase and slightly negative in the operation phase.

(2) Soil Erosion and Sedimentation

Road construction will intensify the effects of natural soil erosion due to vegetation removal, soil disturbance, and exposure of bare soil surfaces. The most severe problems will be associated with embankment construction in the plain area, road sections with heavy cuts and fills, borrow and spoil sites, as well as bridge and culvert construction sites, particularly on rainy days. Soil erosion decreases the agricultural potential of the affected land with consequences for the economy of the region.

(3) Air Quality

During the construction phase, the use of construction equipment and vehicles will increase the level of dust and emissions not only in the work areas, but also along the permanent and temporary roads to quarries, borrow pits and sand pits as well as disposal sites for spoils and waste. The impact is negative and significant.

During the life of the road, vehicle exhaust fumes will increase due to traffic growth. The impact will be most significant in towns. The impact is negative due to negative health implications.

(4) Noise and Vibration

Certain levels of noise pollution are unavoidable at major construction sites. Excessive noise, however, can be a nuisance to construction workers, farm workers and people who live close to the road, and in extreme cases could be a health hazard.

Construction activities involving heavy duty machinery, vehicular movement, vehicle horns, etc. will increase ambient noise levels and vibration beyond the immediate road corridor. Noise and vibration will also occur as a result of the creation of sandpits and borrow pits, and other construction activities such as tipping and turning of heavy-duty trucks and other trucks and compacting of gravel spread on the road. The effects of this impact include welfare and physiological disruptions. Vibrations can damage roadside structures, particularly makeshift or lightly constructed buildings. The impacts are negative and significant. Mitigation measures are required to reduce noise and vibration in the construction phase to the EPA acceptable ambient

noise level of 55 dBA between the hours of 06:00 to 22:00, for residential, educational and other facilities.

(5) Expropriation of Farmland and Forest Reserves

The need to improve the vertical and horizontal alignments of some sections of the existing road will cause farmland to be destroyed. Where new bridges will be constructed across the Volta River and other rivers, farmland is likely to be destroyed. In the project roads area, there are several intersections that need to be properly designed and constructed. All these activities at the construction phase will result in the destruction of farmland and natural vegetation. Vegetation cover, once established, is central to maintaining the ecosystem of an area. Destruction of vegetation has a multitude of negative effects on other environmental attributes which include reduced capacity for water infiltration, increased rate of surface runoff, reduced groundwater recharge, reduced water quality through increased sedimentation, accelerated soil erosion, reduced production of atmospheric oxygen, and loss of habitat for wildlife. The impacts on farmland and forests are considered to be negative and significant and mitigation measures are required.

(6) Landscape Modification

It is proposed to use borrow pits during rehabilitation of the road. Disfiguration of the landscape by embankments, deep cuts, fills and quarries as well as roadside littering are also expected to take place during the construction and operation phases of the project. There will be destruction of beautiful landscapes rich in vegetation and wildlife in the ROW created by the project roads. Furthermore, disused borrow pits if not rehabilitated, could serve as breeding grounds for mosquitoes and vectors of other water-borne diseases.

The landscape is considered to be environmentally sensitive along the entire section of the project roads. The impact of sandpits, borrow pits and dumpsites on the aesthetic and visual quality and value of the landscape is thus considered to be negative and highly significant. Mitigation measures are required to reduce these environmental impacts.

(7) Flora and Fauna

a) Flora

Vegetation must be cleared and trees felled where borrow pits have been proposed and on sections where there is horizontal realignment of the road. The clearing of vegetation causes destruction or damage to terrestrial wildlife habitats, biological resources or ecosystems that should be preserved. Emissions and spilled oil that will be washed out from the road are also likely to have negative effects on the growth of plants by the roadside. These impacts are considered to be negative but moderate since the actual areas involved will not be large. Mitigation measures are required to reduce the negative impacts.

b) Fauna

The impact on fauna is expected to be low since the destruction of vegetation and other human activities have already caused paucity of fauna along the existing roads. The noise and vibration from the construction works will frighten the few reptiles and birds and probably drive

them from their habitat.

(8) Traffic Diversion

Travellers and commuters may experience possible inconvenience due to road diversions during the construction period. The traffic diversions could result in traffic congestion, increased waiting times and traffic accidents. This will be for a limited period, but will have direct bearing on economic activity in the predominantly farming area. The impact on road users is significant and negative. Mitigation measures are required during the construction phase.

(9) Construction Wastes

Large quantities of construction wastes will be generated while construction and upgrading of the roads. Poor sanitation and solid waste disposal in construction camps and work sites are likely to have negative impacts on human health. The improper handling and disposal of construction wastes would have a negative impact on the environment.

(10) Construction Camps

Temporary construction camps will be required for housing construction workers, and storing construction vehicles, equipment, fuel and road-building materials. Establishing new construction camps may involve the bulldozing and levelling of pieces of ground, and erection of temporary or permanent housing units. This could destroy an area, leading to obvious consequences on soil erosion and water quality, if the camp is poorly sited and or constructed. Indiscriminate dumping of engine oils, fuel, lubricants or other solvents could contaminate soil and leach into subsoil water.

The impacts of construction camps are negative and significant. Mitigation measures are required.

(11) Traffic Safety

Conflicts will occur between passing vehicles and the activities in the work areas. Such conflicts will be most pronounced on the Asutsuare – Aveyime road. The movement of construction vehicles and workers, pedestrians and non-construction vehicles in these settlements will result in conflicts. The safety of vehicle users and pedestrians may be endangered by an increased risk of collisions with construction equipment or unsafe road conditions.

When the project is completed, accident rates could rise due to speeding on the improved roads. Indirectly, construction and upgrading of roads will induce commercial, industrial and residential developments along these roads.

The impacts are considered to be significant and negative in the construction and operation phases. Mitigation measures are therefore required in the construction and operation phases.

(12) Public Health

The influx of construction workers as well as freight vehicle drivers into the area could increase the risk of spreading sexually transmitted infections (STIs) and HIV/AIDS to rural inhabitants. In addition, the safety of vehicle users and pedestrians may be endangered by an

increased risk of collisions with construction equipment or unsafe road conditions.

Standing water in borrow pits, quarries and pools near the road is a health hazard to nearby residents since it serves as a breeding site for vectors of disease such as mosquitoes and snails which transmit malaria and bilharzia. During the rainy season, many people may use these pools of water for domestic purposes and watering of livestock, thereby increasing health risks. Reworking and reclamation of existing borrow pits and installation of sufficient culverts will reduce the risk of standing water and associated health hazards.

(13) Community Cohesion and Social Disruption

The social fabric of rural settlements, especially the smaller ones, may be disrupted by an influx of construction workers and the opportunities these pose for providing services and forging new relationships. The construction camps may severely disrupt the social fabric of settlements by exposing residents to different norms and practices.

Appendix 13 Results of Public Consultations

The GHA conducted initial public consultations for both construction of new road between Asutsuare Jct. and Asikuma Jct. and upgrading of the Asutsuare – Aveyime road at Asutsuare on 10th September, 2012 and at Juapong on 11th September, 2012. Each of the public consultations is summarized as follows.

(1) Public Consultation at Asutsuare

a) Overview

- Date: September 10, 2012
- Place: Osudoku Senior High Technical School
- Style: Public meeting
- Number of attendants: 328
- Chiefs and traditional community's key persons: 9
- GoG officials: 9 including Minister of Roads and Highways, and Members of Parliament
- Language: English and 2 local languages

b) Major Comments from the Public and Response from the GHA or Other Government Officials

Table A13-1 Comments and Responses in the Public Consultation at Asutsuare

Comments from the Public	Responses from GHA or GoG officials
- Schedule of the project.	The GHA described the status of the Study and expected detail design, but no specific schedule was announced.
- The reason for excluding the Juapong to Mafi Adidome road from construction of Asutsuare Jct. and Asikkuma Jct.	The road project is now under another agency, but it is at the procurement stage at present.
- Without government officials supervision on site, contractors tend to do poor quality road construction work. The GHA should monitor the contractors and make sure the road quality is good.	The MRH/GHA will assure proper implementation of the road construction work.
- In the past, due to the lack of government funds, PAPs agreed to relocate before full payment. However, some PAPs never received the rest of the compensation without proper explanation. The GHA should take this issue seriously and prevent.	The MRH/GHA will ensure necessary mitigation measures including payment of compensation and recovery assistances.
- Why the road will not pass through Asutsuare township.	Asutsuare was excluded because it would require too much involuntary resettlement.
- During the construction of the Kpong Dam, some PAPs were not compensated. For the proposed road projects, all PAPs should be compensated.	The MRH/GHA will ensure that the necessary mitigation measures are taken in accordance with the resettlement policy. The issue of the Kpong Dam is not clear due to the different jurisdiction.

Source: Study Team

c) General Responses from the Public

No objections to the proposed projects were made. In general, the attendants agreed with the proposed projects and were keen to see them actually implemented. Historically, many projects were promised not only roads but also other public facilities, especially before elections. People in general are sceptical about politicians' promises. As the minister himself explained his strong intention that the proposed projects be carried out, the attendants seemed excited about the high

priority status of the projects.

d) Selected Pictures



Photo A13-1 Project Description by Planning Director of GHA



Photo A13-2 Meeting hall (front left →back right)



Photo A13-3 Meeting hall (front right →back left)



Photo A13-4 Additional attendants next to the meeting hall



Photo A13-5 English presentation followed by two local language translations



Photo A13-6 Some responses by Minister of Roads and Highways

Photos by the Study Team, September 2012

(2) Public Consultation at Juapong

Though the Juapong community is not directly affected by the proposed projects, it was chosen due to its central role between proposed bridge across the Volta River and N2 Asikuma Jct.

a) Overview

- Date: 11th September, 2012
- Place: St.Francis of Assisi Catholic Church
- Style: Public meeting
- Number of attendants: 376
- Chiefs and traditional community's key persons: 70
- GoG Officials: 8 including Members of Parliament
- Language: English and 2 local languages

b) Major Comments from the Public and Response from the GHA or Other Government Officials

Table A13-2 Comments and Responses in the Public Consultation at Juapong

Comments from the Public	Responses from GHA or GoG Officials
- The reason for excluding the Juapong to Dufor Adidome road from construction of Asutsuare Jct. and Asikkuma Jct.	The road project is now under another agency, but it is at the procurement stage at present.
- The reason for little description of Dufor Adidome's resettlement requirements despite the social environmental survey.	The GHA will conduct a detailed survey at a later stage. This time, the consultants conducted a survey for rough estimation purpose only.
- Request to hire young local people for the project implementation.	No specific response was given.

Source: Study Team

c) General Responses from the Public

No objections to the proposed projects were made. The majority of comments concerned the Juapong to Dufor Adidome road, which has been postponed for some reason and people are anxious about implementation of the project. However, in general, the attendants agreed with the proposed projects and are keen to see them actually implemented. Some Juapong based people are concerned about depopulation of Juapong and reduction of business opportunities due to construction of road between Asutsuare Jct. and Asikuma Jct.

d) Selected Pictures



Photo A13-7 Project Description by Planning Director of GHA



Photo A13-8 Meeting hall (back → front)



Photo A13-9 Meeting hall (front right → back left)



Photo A13-10 Attendants' registration



Photo A13-11 English presentation followed by two local language translation



Photo A13-12 Some responses by Member of Parliament (Volta Region)

Photos by the Study Team, September 2012

Appendix 14 Scope of Resettlement Impact

14.1 Summary of the Population and Housing Census

The GoG conducted a population and housing census in 2010 and has been processing the results. As of September 2012, only a summary report of the final results was available for the general public. The summary report covers both population and housing census results at the regional level and the appendix includes the population at the district level. With the support of the GSS, MoFEP, the Study Team could obtain the population and selected socio-economic data at the district level. The following are the key findings of the 2010 population census and district level data sheets for the purpose of understanding the socioeconomic setup for the project affected area (Dangbe West District in Greater Accra Region, North Tongu District in Volta Region, and Asuogyaman District in Eastern Region): 1) population, 2) ethnicity, 3) religion, 4) educational level, and 5) economic activities.

(1) Population

The population of Ghana in 2010 was 24,658,823, up 30.4% from 2000. The age-sex structure is shown in the following figure. Based on the summary report, the present structure reflects the effects of high fertility and decreasing mortality rate. The populations in the project affected districts and regions are shown in Table A14-1.

Table A14-1 Population in the Project-Affected Districts

Region/ District	Ratio in Region	Total	Male	Female	No. of Households	Household size	Urban	Rural
Greater Accra		4,010,054	1,938,225	2,071,829	1,036,426	3.8	3,630,955	379,099
Dangbe West	3.1%	122,836	58,806	64,030	26,489	4.5	41,629	81,207
Volta		2,118,252	1,019,398	1,098,854	495,603	4.2	713,735	1,404,517
North Tongu	7.0%	149,188	70,282	78,906	31,573	4.7	43,410	105,778
Eastern		2,633,154	1,290,539	1,342,615	632,048	4.1	1,143,918	1,489,236
Asuogyaman	3.7%	98,046	47,030	51,016	23,551	4.1	28,788	69,258

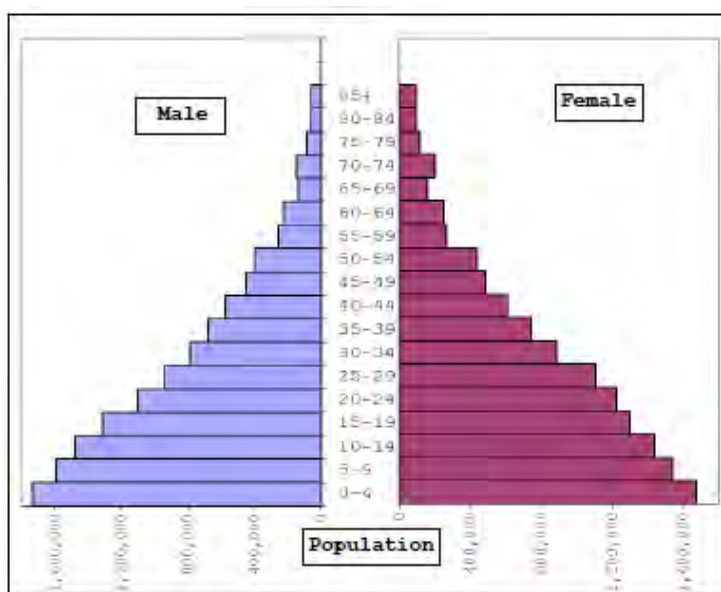
Source: 2010 Population and Housing Census, May 2012, GSS

(2) Ethnicity

Table A14-2 shows the ethnicity of the project affected regions. The ethnicity ratios vary greatly among the three affected regions.

(3) Religion

Table A14-3 shows the religions in the project affected districts. The religion ratios vary greatly among the three affected districts. In all districts, Pentecostal/Charismatic accounts for the majority, followed by Protestants. There are slight differences among project affected districts, but the distribution of religions is similar.



Source: 2010 Population and Housing Census, May 2012, GSS

Figure A14-1 Age-Sex Structure of Population

Table A14-2 Ethnicity in the Project-Affected Regions

Ethnicity	National	Greater Accra	Ratio in Region	Volta	Ratio in Region	Eastern	Ratio in Region
Akan	47.5%	1,528,722	39.7%	55,736	2.8%	1,312,977	51.1%
Ga-Dangme	7.4%	1,056,158	27.4%	31,130	1.5%	460,814	17.9%
Ewe	13.9%	775,332	20.1%	1,482,180	73.8%	486,136	18.9%
Guan	3.7%	73,409	1.9%	162,981	8.1%	137,386	5.3%
Gurma	5.7%	62,435	1.6%	227,282	11.3%	42,291	1.6%
Mole-Dagbani	16.6%	200,735	5.2%	9,473	0.5%	83,311	3.2%
Grusi	2.5%	48,822	1.3%	2,214	0.1%	19,412	0.8%
Mande	1.1%	28,656	0.7%	1,591	0.1%	6,771	0.3%
Others	1.4%	75,568	2.0%	36,313	1.8%	20,377	0.8%

Source: 2010 Population and Housing Census, May 2012, GSS

Table A14-3 Religion in the Project-Affected Districts

Ethnicity	National	Greater Accra	Dangbe West	Volta	North Tongu	Eastern	Asuogyaman
No religion	5.3%	3.4%	5.4%	6.6%	7.4%	6.5%	4.1%
Catholic	13.1%	7.5%	4.9%	17.6%	11.5%	7.9%	8.4%
Protestant	18.4%	22.3%	19.0%	21.5%	27.0%	24.8%	28.7%
Pentecostal/Charismatic	28.3%	44.6%	52.0%	26.6%	31.3%	36.3%	36.1%
Other Christian	11.4%	8.9%	9.8%	7.1%	10.7%	15.5%	15.9%
Islam	17.6%	11.4%	5.3%	5.4%	2.8%	6.3%	3.5%
Ahmadi		0.4%	0.3%	0.3%	0.4%	0.4%	0.2%
Traditionalist	5.2%	0.5%	2.1%	14.1%	8.3%	1.4%	2.4%
Other	0.8%	1.0%	1.1%	0.8%	0.7%	0.9%	0.8%

Source: 2010 Population and Housing Census, May 2012, GSS

(4) Education

Table A14-4 shows the educational level in the project affected districts. The education level in Dangbe West District and North Tongu District is similar, while the Asuogyaman District has a slightly higher educational level for both males and females. In all districts, primary school is the most common educational level for males, followed by junior high school and never

attended school. For females, most have either never attended school or attended only primary school. Regarding higher education for both males and females, the Dangbe West District and Asuogyaman District have slightly higher proportions than North Tongu District. Based on the census data, there is no critical gender segregation in the project area.

Table A14-4 Educational Level of Project-Affected Districts

Educational Level	Nation	Greater Accra	Dangbe West		Volta	North Tongu		Eastern	Asuogyaman	
			Male	Female		Male	Female		Male	Female
Never attended	23.4%	10.0%	18.2%	30.0%	24.1%	16.2%	30.8%	17.1%	8.9%	19.8%
Nursery	3.2%	0.2%	0.6%	0.5%	0.4%	0.6%	0.5%	0.3%	0.2%	0.3%
Kindergarten	5.4%	1.2%	2.4%	2.2%	2.5%	3.6%	3.0%	2.5%	2.6%	2.4%
Primary school	24.8%	22.3%	29.0%	29.1%	29.3%	31.6%	31.1%	29.7%	28.5%	29.5%
Junior secondary school/Junior high school	18.7%	23.0%	21.7%	20.0%	20.0%	22.6%	20.0%	23.2%	23.9%	23.4%
Middle school	8.3%	10.8%	8.7%	5.9%	10.1%	9.8%	6.5%	13.1%	14.5%	11.3%
Senior secondary school/Senior high school	8.1%	13.6%	8.8%	5.8%	7.3%	9.1%	5.6%	7.2%	9.7%	7.1%
Secondary school	1.2%	3.2%	1.6%	0.7%	0.9%	0.9%	0.4%	1.1%	1.3%	0.5%
Vocational/Technical/Commercial	1.6%	4.1%	2.5%	1.5%	1.5%	1.2%	0.7%	1.6%	2.7%	1.7%
Post middle/secondary certificate	1.1%	1.5%	1.1%	0.8%	1.4%	1.5%	0.8%	1.2%	1.3%	1.2%
Post secondary diploma	2.1%	4.4%	2.7%	2.0%	1.7%	1.8%	0.5%	1.8%	3.5%	1.9%
Bachelor degree	1.7%	4.5%	2.2%	1.3%	0.7%	0.8%	0.2%	1.0%	2.3%	0.9%
Post graduate (Cert. Diploma, Masters, PHD, etc.)	0.3%	1.0%	0.5%	0.1%	0.1%	0.2%	0.0%	0.2%	0.6%	0.1%

Source: 2010 Population and Housing Census, May 2012, GSS

(5) Economic Activity

Tables A14-5 to A14-9 show the status of economic activity (15 years and older) in the project affected districts. The ratios of the respective activity statuses are similar among all districts. The unemployed ratio is slightly higher in the Asuogyaman District. Regarding economic activity by industry, agriculture, forestry and fishery account for the highest number in all districts, followed by manufacturing. Wholesale and retail is second highest for females in all districts.

Table A14-5 Status of Economic Activity (15 years and older)

Activity Status	Greater Accra	Dangbe West		Volta	North Tongu		Eastern	Asuogyaman	
		Male	Female		Male	Female		Male	Female
Employed	65.3%	65.3%	68.1%	67.0%	65.3%	68.1%	68.6%	65.1%	63.1%
Unemployed	5.9%	2.9%	2.6%	2.9%	2.9%	2.6%	4.1%	5.6%	5.1%
Not active	28.8%	31.8%	29.3%	30.1%	31.8%	29.3%	27.3%	29.3%	31.7%

Source: 2010 Population and Housing Census, May 2012, GSS

Table A14-6 Economically Active Population in Dangbe West District

(Unit: person)

Activity Status	Employed		Unemployed		Not Active	
	Male	Female	Male	Female	Male	Female
Employee	8,079	2,861	139	87	-	-
Self employed without employee(s)	11,636	17,984	112	343	-	-
Self employed with employee(s)	1,127	857	8	13	-	-
Casual worker	864	270	26	9	-	-
Contributing family worker	1,299	1,957	7	13	-	-
Apprentice	472	624	6	13	-	-
Domestic employee (Househelp)	132	148	3	4	-	-
Other	61	20	0	2	-	-
New workers seeking employment	0	0	1,168	1,584	10,119	13,995
Total	23,670	24,721	1,469	2,068	10,119	13,995

Source: 2010 Population and Housing Census, May 2012, GSS

Table A14-7 Economically Active Population in North Tongue District

(Unit: person)

Activity Status	Employed		Unemployed		Not Active	
	Male	Female	Male	Female	Male	Female
Employee	5,485	3,906	1,579	68	36	-
Self employed without employee(s)	44,481	18,306	26,175	48	115	-
Self employed with employee(s)	1,285	703	582	7	5	-
Casual worker	995	668	327	9	4	-
Contributing family worker	8,144	3,267	4,877	2	5	-
Apprentice	630	252	378	2	2	-
Domestic employee (Househelp)	384	148	236	1	0	-
Other	103	43	60	0	0	-
New workers seeking employment	0	0	0	1,063	1,131	13,299
Total	61,507	27,293	34,214	1,200	1,298	13,299

Source: 2010 Population and Housing Census, May 2012, GSS

Table A14-8 Economically Active Population in Asuogyaman District

(Unit: person)

Activity Status	Employed		Unemployed		Not Active	
	Male	Female	Male	Female	Male	Female
Employee	9,517	6,924	2,593	126	88	-
Self employed without employee(s)	24,863	9,438	15,425	44	163	-
Self employed with employee(s)	1,197	584	613	1	3	-
Casual worker	540	375	165	6	8	-
Contributing family worker	2,066	746	1,320	1	2	-
Apprentice	905	354	551	3	13	-
Domestic employee (Househelp)	150	63	87	0	0	-
Other	94	66	28	1	2	-
New workers seeking employment	0	0	0	1,424	1,412	8,342
Total	39,332	18,550	20,782	1,606	1,691	8,342

Source: 2010 Population and Housing Census, May 2012, GSS

Table A14-9 Economic Activity of Employees by Industry (15 years and older)

(Unit: person)

Activity Status	Dangbe West		North Tongu		Asuogyaman	
	Male	Female	Male	Female	Male	Female
1. Agriculture, forestry and fishery	9,169	6,274	17,455	20,523	8,057	6,533
- Mining and quarrying	799	319	318	140	73	35
2. Manufacturing	2,077	4,582	2,281	4,029	1,925	3,035
- Electricity gas stream and air conditioning supply	60	8	30	2	996	176
- Water supply; sewerage waste management and remediation activities	87	81	73	42	90	29
3. Construction	2,714	93	1,256	33	1,216	28
4. Wholesale and retail; repair of motor vehicles and motorcycles	1,823	6,729	1,457	4,967	1,053	5,499
5. Transportation and storage	2,621	130	1,103	59	1,353	72
- Accommodation and food service	320	3,191	177	1,952	240	1,922
- Information and communication	112	41	37	7	83	33
- Finance and insurance	158	99	94	24	148	77
- Real estate	72	9	2	1	3	-
- Professional scientific and technical	279	89	122	78	255	535
- Administrative and support service	254	62	152	36	324	57
- Public administration and defence; compulsory social security	1,046	215	236	67	281	90
- Education	848	835	1,252	686	1,047	984
- Human health and social work	186	278	478	322	565	302
- Arts entertainment and recreation	230	31	128	12	167	18
- Other service activities	678	1,488	526	1,051	506	1,103
- Activities of households as employers; undifferentiated goods and services, producing activities of households for own use	131	165	113	183	167	254
- Activities of extraterritorial organisations and bodies	6	2	3	-	1	-
Total	23,670	24,721	27,293	34,214	18,550	20,782

Source: 2010 Population and Housing Census, May 2012, GSS

14.2 Summary of Socioeconomic Survey

(1) Positive Impacts of Construction Phase

a) Job Creation

During the construction phase, there will be opportunities for skilled as well as unskilled workers to earn income. People skilled in driving heavy equipment, trucks and other artisans are expected to be engaged. Some women will also seize the opportunity to provide various services to the contractors and workers, especially the sale of food. About 96% of respondents believed that the project will boost employment opportunities for men and women during the construction phase.

b) Increasing Trading Activities, especially for Women

Women who sell along the road side will benefit from an increase in business because construction workers will buy their products. Some people will also burn some demolished trees

into charcoal for domestic use.

(2) Negative Impacts of Construction Phase

a) Demolition of Properties

There are various types of structures along the roads and within the ROW: some temporary structures and some permanent structures will be affected. The road alignment will result in some property owners either partially or completely losing their properties. Some properties may be completely removed and others blighted which may indirectly reduce their quality and value in the short term.

b) Destruction of Farmlands and Other Important Areas of Value

The construction of the project roads will very likely affect farmlands with various crops and economic trees along the road. This will create untold hardships for men and women.

c) Increase in Dust and Noise Levels

Levels of dust will rise significantly because of dirt on the road, and vehicular movement and wind will stir up dust. Loading and unloading of dump trucks will also generate dust and reduce air quality. When air quality is poor, upper respiratory tract infections increase, asthmatics have more attacks and dust also causes eye irritation.

Noise levels will increase as a result of activities such as, movement of vehicles and earth-moving equipment, drilling, hammering, emptying and loading of trucks, and noise of workers. Moreover, piercing noise caused by drilling machines for example will cause high noise levels while in operation. High noise levels are known to cause stress, headaches and when persistent, hearing impairment.

d) Impact on Public Health and Safety

The construction of roads will bring an influx of additional persons into the road corridor. Construction workers will be made up mainly of men who are separated from their regular partners. Such persons tend to indulge in risky sexual behaviour which increases the incidence of STDs and HIV/AIDS.

The increase in dust levels could increase the incidence of colds and other upper respiratory infections in the general populace in the corridor. Construction of drains tends to leave uncovered trenches that collect rain water especially during the wet season and become breeding grounds for mosquitoes. This may mean that the incidence of malaria may increase in the corridor.

e) Impact on Traffic Movement

During construction, movement of traffic along the route will be difficult, riding comfort will be poor and speeds will be low, so traffic will tend to crawl and this will increase travel time. It will take longer to cross the corridor than it did before construction commenced.

f) Disruption and Reduction in the Supply of Utility Services

The communities along the arterial roads may experience some disruption and reduction in the supply of utility services such as water, electricity and telecommunications in the short term. These community utility services may be interrupted due to the relocation of service lines and

poles, but this will only be in the short term.

g) Impact on Business Operation and Income

Some roadside sellers will suffer demolition of their structures and if unmitigated, they may lose their businesses all together. Table-top sellers and kiosk operators in the towns may also lose their business sites and would need to relocate. However, where space is available beyond the ROW, roadside sellers may only need to be assisted to move the structures backward and face very short-term disruption to their business activities. If they have to relocate elsewhere, they may face transportation costs that may be overwhelming considering the general poverty in the area.

The dust, noise and difficulty in travelling along the route will all impact on business operations. During the dry season, dust will cling to items on display or cover netting and discolour walls. All this will adversely affect the ambience and have a negative impact on business operations. Past experiences of construction on other road corridors has shown that business in those areas dips during construction due to a fall in the number of customers. Such a fall will result in loss of income. Increased cleaning costs will also aggravate the loss of income. On some days high levels of noise will make it difficult for businesses premises abutting the road to operate, resulting and that will result in their closing down for the day.

(3) Positive Impacts of Operational Phase

a) Improved Road Infrastructure and Transport Service

It is expected that during the operational phase, when the roads road infrastructure have been improved, there will be free flow of traffic. This will reduce vehicle operating costs and travel time. The provision of parking lots, drains, bus stops and a better road surface will also reduce vehicle-pedestrian conflicts and travel cost. The overall effect on vehicle operating costs will be positive and significant for road users.

b) Increase in Local Economic Activities

It is expected that with the completion of the Benchema – Adwufia road project, more businesses as well as customers will be attracted than before. Hence, business activities will flourish and have a impact significantly impact on the communities. It is also expected that the population will increase along the road. This will lead to an increase in demand for goods and services. In the longer term, the project will lead to increased business activities and strengthen local economies, thus helping to reduce poverty in the area.

c) Increase in Property Values

The value of properties along the road is expected to increase since most of them will have a new facelift as the landscape becomes more beautiful with the new road, particularly the new bridge across the Volta River.

d) Public Health and Safety

The existing roads do not have proper drainage systems and some of them are very dusty. This is detrimental to the well-being of the people who live alongside such roads. The road projects will include improvement of the alignment and the road surface and construction of

drainage structures. With such improvements, flooding will be prevented and stagnant water will be eliminated, thus reducing the occurrence of certain diseases like malaria, typhoid, diarrhoea and asthma.

e) Traffic Safety

When roads are upgraded, the road surface and travel comfort improves and with moderate speeds and facilities for greater pedestrian safety, some accidents that are now common may reduce significantly. The project will solve some of the vehicle-pedestrian conflicts along the section. The provision of sidewalks, pedestrian crossings and other traffic management schemes will reduce accidents.

f) Beautification of Affected Communities

With the completion of the project, the communities along the project roads will look more beautiful and therefore attract more people and more commercial properties into the area.

g) Impact on Land Use

The land abutting the road is used for farming, residences, artisanship and small trading activities. When the road is upgraded, some of the unused lands may be developed into residential and commercial areas and the value of properties will tend to increase. Some property owners will also scale up their property to attract higher rents.

h) Improved and Easier Access to Social Amenities

The delivery of education services, markets, hospitals, etc. is expected to be made much easier through the provision of better transport services. For instance, more teachers will accept postings to schools on the road corridor.

(4) Negative Impacts of Operational Phase

a) Vehicler-Pedestrian Conflicts and abuse of Traffic Regulations

Quite a number of respondents expressed fears that once the road is paved, drivers are likely to flout traffic regulations and exceed speed limits(even in communities), in a bid to shorten their travel time and maximise profits. This could result in knocking down of pedestrians, cyclists and animals. Another abuse is careless overtaking and consequent fatal accidents.

b) Increase in Criminality and Prostitution

While the influx of people into the road influence area is likely to boost the local economies, the ease of movement may also facilitate an influx of criminals and prostitutes engaging in highway robbery, stealing and prostitution.

c) Impact on Public Health and Safety

The construction of international trunk roads will bring an influx of additional persons into the road corridor. Freight vehicle drivers will be made up mainly of men who are separated from their regular partners. Such persons tend to indulge in risky sexual behaviour which increases the incidence of STDs and HIV/AIDS.

14.3 Results of Consultations with Potentially Affected Persons for Construction of New Road between Asutsuare Jct. and Asikuma Jct.

(1) District and Communities of Project-Affected Persons

The survey was conducted in three districts namely: Asuogyaman, Dangme West and North Tongu. In total, 210 respondents (132 males and 78 females) were interviewed. The distribution of the respondents among the districts was as follows: Asuogyaman 26 (18.1% of respondents); Dangme West 117 (55.7%), and North Tongu 55 (26.2%).

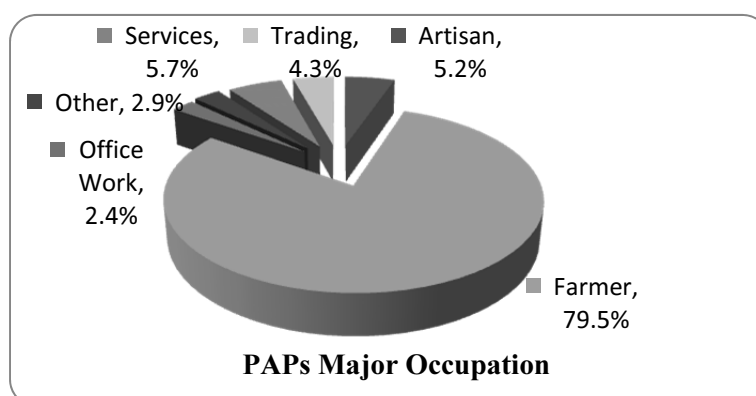
**Table A14-10 Districts and Communities of Projected Affected Persons
(Construction of New Road between Asutsuare Jct. and Asikuma Jct.)**

District	Community	Male		Female		Total	
		Number	%	Number	%	Number	%
Asuogyaman	AbotiaNorvisi	9	4.3	4	1.9	13	6.2
	Amesianyakope	3	1.4	0	0	3	1.4
	Asikuma	8	3.8	6	2.9	14	6.7
	Dangbe	6	2.9	2	1.0	8	3.8
Asuogyaman Total		26	12.4	12	5.7	38	18.1
Dangme West	Asutsuare Junction	7	3.3	1	0.5	8	3.8
	Lubuse	35	16.7	20	9.5	55	26.2
	Osuwem	10	4.8	7	3.3	17	8.1
	Tanya	6	2.9	6	2.9	12	5.7
	Volivo	11	5.2	14	6.7	25	11.9
Dangme West Total		69	32.9	48	22.9	117	55.7
North Tongu	Dufor Adidome	34	16.2	16	7.6	50	23.8
	Osiabura	3	1.4	2	1.0	5	2.4
North Tongu Total		37	17.6	18	8.6	55	26.2
Grand Total		132	62.9	78	37.1	210	100

Source: Study Team

(2) Occupations of Respondents

Six major occupation categories were identified in the communities. Figure A14-2 shows that the vast majority (79.5%) of the respondents were crop farmers, followed by the services sector (5.7%), artisans (5.2%) and trading (4.3%).



Source: Study Team

**Figure A14-2 Major Occupation of Respondents
(New Road between Asutsuare Jct. and Asikuma Jct.)**

(3) Potentially Affected Properties

Table A14-11 shows potentially affected properties by construction of new road between Asutsuare Jct. and Asikuma Jct.

**Table A14-11 Potentially Affected Properties
(New Road between Asutsuare Jct. and Asikuma Jct.)**

Affected Properties	Male	Female	Total
	Number	Number	Number
House	1	0	1
Storage/hut	10	8	18
Farm	99	55	154
Container	1	1	2
Kiosk	1	1	2
Kitchen	1	0	1
Land	1	3	4
Wooden Shed	0	1	1
Fish Pond	2	1	3
Total	114	69	183**

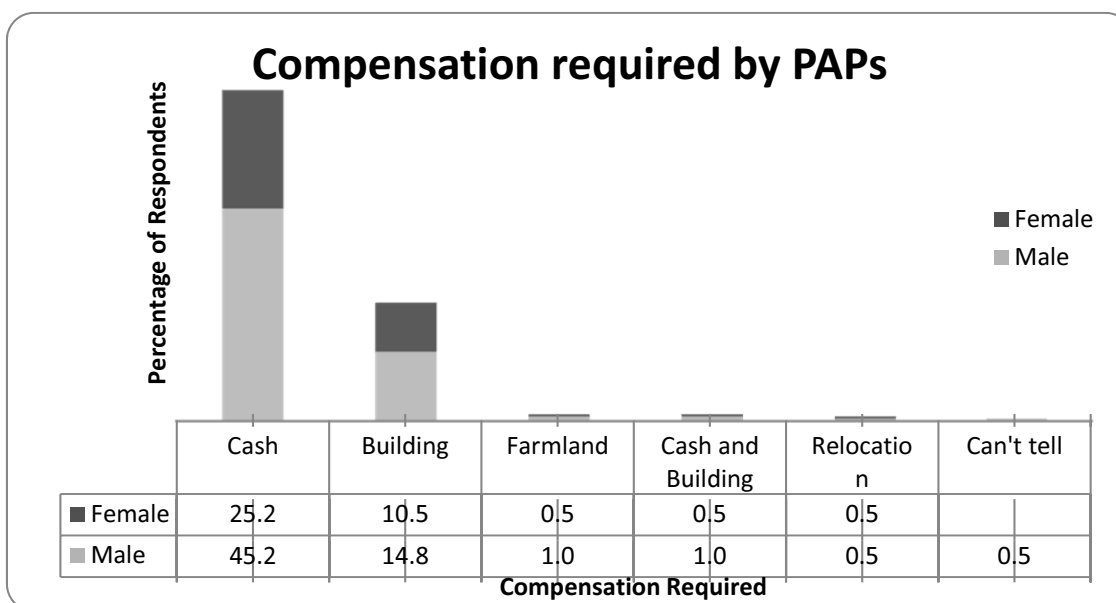
Notes: * multiple ownership included

** Unless the ENTIRE DISPLACED PAP is fewer than 200, the category of the project would be B and would require ARAP (WB OP4.12) (cf. paragraph 25). A draft resettlement plan that conforms to this policy is a condition of appraisal (see Annex A, paragraphs 2-21) for projects referred to in paragraph 17(a) above. However, where impacts on the entire displaced population are minor, or fewer than 200 people are displaced, an abbreviated resettlement plan may be agreed with the borrower (see Annex A, paragraph 22). The information disclosure procedures set forth in paragraph 22 apply.

Source: Study Team

(4) Type of Compensation Required by PAPs

A majority (70.4%) would want cash compensation. This was followed by 25.3% who would want their affected buildings to be replaced. A further 1.5% said they would prefer both cash and buildings. Of the remaining 2.8%, 1.5% would want farmland as composition.



Source: Study Team

**Figure A14-3 Compensation Required by PAPs
(New Road between Asutsuare Jct. and Asikuma Jct.)**

14.4 Results of Consultations with Potentially Affected Persons for Upgrading of Asutsuare – Aveyime Road

(1) District and Communities of Project Affected Persons

In all, 122 respondents were interviewed in two districts of Dangme West (59.8%) and North Tongu (40.2%). Five communities were selected from Dangme West and one from North Tongu.

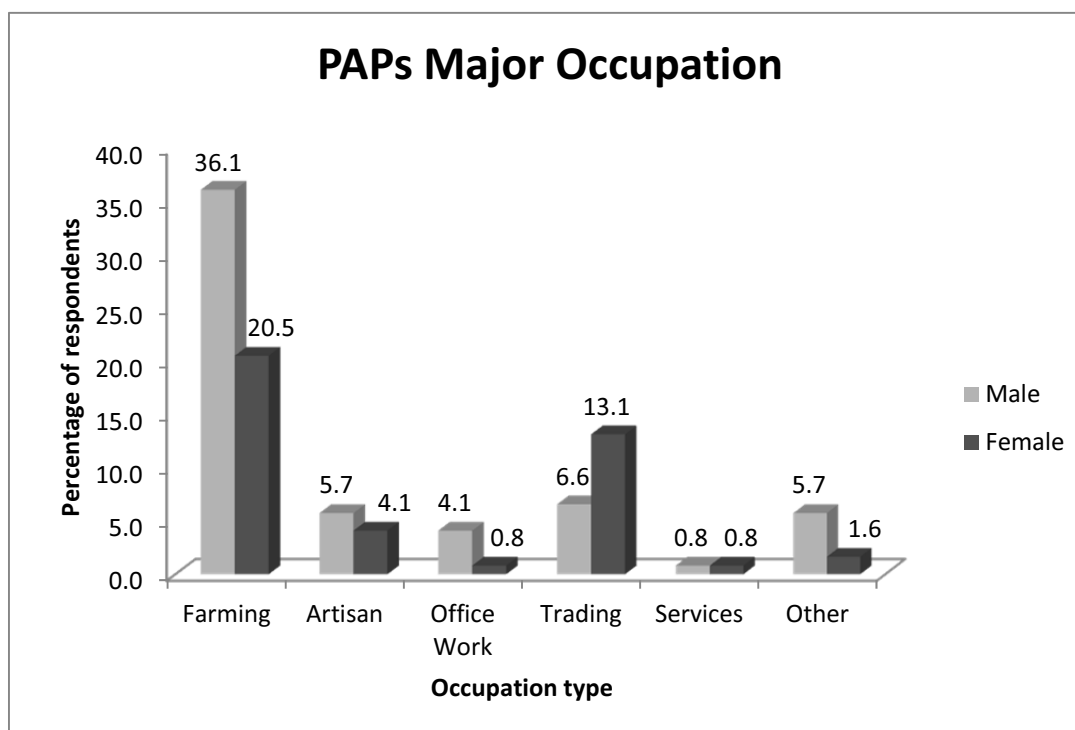
Table A14-12 Districts and Communities of PAPs (Asutsuare – Aveyime Road)

District	Community	Male		Female		Total	
		Number	%	Number	%	Number	%
Dangme West	Asutsuare	15	12.3	7	5.7	22	18.0
	Atrobinya	21	17.2	14	11.5	35	28.7
	Dufor	1	0.8	1	0.8	2	1.6
	Kewum	7	5.7	1	0.8	8	6.6
	Volivo	3	2.5	3	2.5	6	4.9
Dangme West Total		47	38.5	26	21.3	73	59.8
North Tongu	Aveyime	25	20.5	24	19.7	49	40.2
Grand Total		72	59.0	50	41.0	122	100

Source: Study Team

(2) Occupations of Respondents

Six major occupation categories were identified: farming (56.6%), trading (19.7%), artisans (9.8%), office work (4.9%), services (1.6%), and others (7.3%). The farming industry was made up of crop farming (54.9%)



Source: Study Team

Figure A14-4 Major Occupations of Respondents (Asutsuare – Aveyime Road)

(3) Potentially Affected Properties

Table A14-13 shows potentially affected properties by upgrading of Asutsuare – Aveyime road.

Table A14-13 Potentially Affected Properties* (Asutsuare – Aveyime Road)

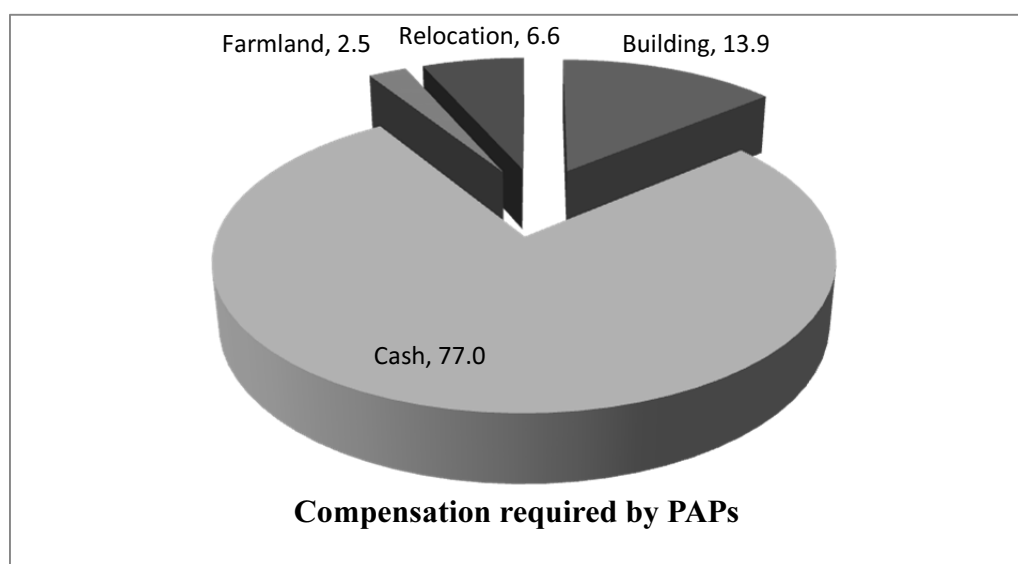
Affected Properties	Male	Female	Total
	Number	Number	Number
House	5	4	9
Farm	45	26	71
Container/Kiosk	1	6	7
Fence wall	0	1	1
Wooden Structure	3	1	4
Total	73	50	113

Note: * multiple ownership included

Source: Study Team

(4) Compensation Required by PAPs

The vast majority (77.0%) of the respondents stated that they would want to have cash compensation, 13.9% would want replacement of their buildings, whilst 6.6% wanted relocation. The rest (2.5%) said they would need farmland.



Source: Study Team

Figure A14-5 Compensation Required by PAP (Asutsuare – Aveyime Road)

Appendix 15 Recommended Monitoring Items and Standards for Environmental Quality Monitoring

All standers shall meet the most updated EPA's guidelines at the time of implementation. As the environmental standards are not available on the EPA's website (www.epa.gov.gh) as of September 2012, GHA and responsible consultants would be required to obtain the updated standers at the EPA office. The following standards were extracted from the EPA's relevant guidelines as of May 2012.

Air Quality (Emission Gas / Ambient Air Quality)			
*EPA Ambient Air Quality Guidelines			
Item	Unit	Country's Standards*	Referred International Standards**
SO ₂	µg/m ³	<Industrial/Project Site> 900 µg/ m ³ -h average 150 µg/ m ³ -24h average 80 µg/ m ³ -1year average <Residential> 700 µg/ m ³ -h average 100 µg/ m ³ -24h average 50 µg/ m ³ -1year average	0.04 ppm/h-daily average 0.1 ppm/h-peak
NO ₂	µg/ m ³	<Industrial/Project Site> 400 µg/ m ³ -h average 150 µg/ m ³ -24h average <Residential> 200 µg/ m ³ -h average 60 µg/ m ³ -24h average	0.04-0.06 ppm/h-daily average
CO	mg/ m ³	100 mg/ m ³ -15min average 60 mg/ m ³ -30min average 30 mg/ m ³ -h average 10 mg/ m ³ -8h average	10 ppm/h-daily average 20 ppm/h-peak (consecutive 8h)
Total Suspended Particle Matter	µg/ m ³	<Industrial/Project Site> 230 µg/ m ³ -24h average 75 µg/ m ³ -1year average <Residential> 150 µg/ m ³ -24h average 60 µg/ m ³ -1year average	0.10 mg/m ³ -h-daily average 0.10 mg/m ³ -h--peak
PM ₁₀	µg/m ³	70 µg/m ³ -24h average	N/A
**Japanese Ministry of Environment (J-MOE) Environmental Quality Standards –Air Quality as of September 2012 Due to the <u>units</u> of the items as well as analysis <u>methods are different</u> from Ghanaian and Japanese standards, it is advisable to carefully refer the Japanese standards, especially volume to weight conversion with the effect of temperature.			

Water Quality (Effluent/Wastewater/Ambient Water Quality)			
*EPA Schedule 1 (Regulation 2) of Wastewater Quality Guidelines for Discharges into Water Bodies or Water Courses			
Item	Unit	Country's Standards*	Referred International Standards**
pH	-	6-9	5.8 - 8.6
Total Suspended Solid	mg/l	50	150 mg/l-daily average 200 mg/l-peak
Total Dissolved Solid	mg/l	1,000	N/A
BOD/COD	mg/l	BOD: 200 COD: 1,000	BOD (not into sea and lakes) 120 mg/l-daily average 160 mg/l-peak
Total Nitrogen	mg/l	100	60 mg/l-daily average 120 mg/l-peak
Total Phosphorus	mg/l	10.0	8 mg/l-daily average 16 mg/l-peak
Hydrocarbons / Mineral Oils	mg/l	20	5 mg/l (mineral oil) 30 mg/l (animal/vegetable fats)
Oil	-	No visible floating oil	N/A
** J-MOE Uniform National Effluent Standards as of May 25, 2012			

Noise / Vibration (Ambient)			
* EPA Ambient Noise Level Standards			
Item	Unit	Country's Standards*	Referred International Standards**
Noise level	dB	(day:6AM-10PM/night:10PM-6AM) 55/48: (A: residential area) 55/50: (B1: school and hospital) 60/50: (B2: commercial area) 65/60: (C1: light industry /entertainment/public place) 75/65: (C2: predominantly commercial area) 70/60: (D: light industrial area) 70/70: (E: predominantly heavy industrial area)	85dB <Construction site> working time: 6 am – 10 pm max working time: 14 hours max consecutive work: 6 days prohibited work day: Sundays and holidays <Residential> working time: 6 am – 10 pm max working time: 14 hours max consecutive work: 6 days prohibited work day: Sundays and holidays
Vibration level	dB	No standard at this moment Necessity of vibration control shall be decided based on the discussion of GoG and JICA before the loan agreement with EPA and other authorities' consideration, especially considering practicability of monitoring and acceptability/common practices of residents adjacent to the construction site and roads.	***85dB (Construction Works) max consecutive work: 6 days prohibited work day: Sundays and holidays <Construction site> working time: 6 am – 10 pm max working time: 14 hours <Residential> working time: 7 am – 7 pm max working time: 10 hours 70dB (daytime: motor vehicle) 65dB (nighttime: motor vehicle)
** J-MOE Environmental Quality Standards for water pollution /human health			
*** Appendix II of Vibration Regulation Law #64 of 1976 (amended by Law #75 of 1995)			

Appendix 16 Result of the Road Safety Audit

The report on Road Safety Audit – Stage 2 (Preliminary Design) for the Eastern Corridor Development Project on Construction of Asutsuare Junction – Asukuma Junction and Asutsuare – Aveyime Roads was prepared by the GHA on October 2012. Results of the report are as follows:

REPUBLIC OF GHANA

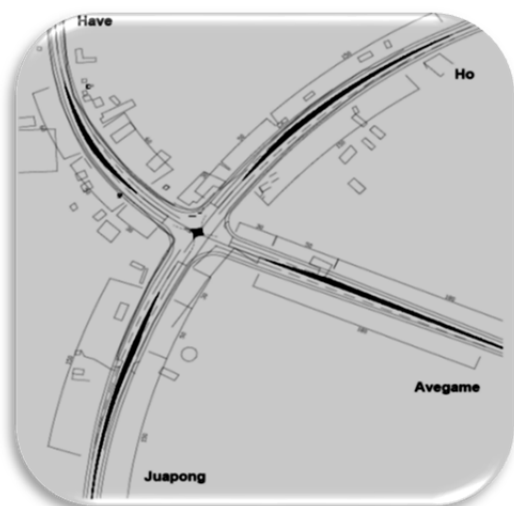


MINISTRY OF ROADS AND HIGHWAYS

GHANA HIGHWAY AUTHORITY

REPORT ON

ROAD SAFETY AUDIT – STAGE 2 (PRELIMINARY DESIGN)



EASTERN CORRIDOR DEVELOPMENT PROJECT

**CONSTRUCTION OF ASUTSUARE JUNCTION-ASIKUMA JUCTION
AND ASUTSUARE-AVEYIME ROADS**

THE CHIEF EXECUTIVE
GHANA HIGHWAY AUTHORITY
HALL OF TECHNOLOGY, ACCRA

OCTOBER, 2012

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1.0 Introduction

The basic objective of road safety audit is the reduction of road casualties through the adoption of a more proactive approach, contrary to traditional blackspot analysis which is a reactive method of identifying high accident locations. The intent is to identify and mitigate problem areas before accidents have a chance to occur.

A stage two (preliminary design) road safety audit was carried out by a multidisciplinary audit team (who are absolutely independent of the design team and had no involvement in the production of the design) between 26th and 29th October, 2012 to ensure that the Asutsuare Junction-Asikuma Junction and Asutsuare-Aveyime roads would not jeopardize the safety of motorist and other road users using the roadway after completion. The field audit was carried out during daylight hours.

This document is a Report of the study carried out at stage 2 (Draft Design). The project consists of Ninety-Seven (97) Highway Drawings. These are:

1. Plan and profile (31 Drawings)
2. Typical Cross Sections (2 Drawings)
3. General plan of bridges (4 Drawings)
4. Cross sections (58 Drawings)
5. Intersections (2 Drawings)

The audit covers an assessment of the above drawings relating to the project road supplied by the designer as well as the examination of physical and visual features of the study area which may affect road users' safety. Traffic conflict studies at major intersections and a review of road traffic crashes data, as well as socio-economic activities and other contextual issues along the entire project corridor that might affect the safety performance of the roadway, were also undertaken.

This Stage 2 Road Safety Audit has been carried out in accordance with the relevant sections of Ghana Highway Authority's Road Safety Audit procedures. The Audit Team has examined only those issues within the design relating to the road safety implications of the scheme.

In this report, issues considered to be potentially risky for accident occurrence have been raised. The reason for concern for the issues raised/observations made have been addressed. In addition, opportunities that exist (Recommendations) for improvements in safety for all road users have been provided.

The Road Safety Audit was undertaken by the following:

Victor Owusu, BSc, MPhil, MGhIE, MCIHT, MSoRSA- Team Leader

Harold Atobra-Acheampong, BSc, MGhIE – Member

Anthony K. Spio, HND Civil Engineering – Member

Bernard Owusu, BSc, MGhIE – Member

2.0 General Safety Concerns

2.1 Highway Classification and Design Speed on Mainline

a) Observation

The project road traverses through densely populated communities and large agricultural lands. Socio-economic activities are soaring with the rapid development of commercial, residential and social amenities along the route belt.

According to distribution of urban centers and populations along the roadside, forecast traffic, the project function and its role in the network, the evaluation was carried out to the proposed highway classification from the concern of adaptability to operating safety.

The road traffic crashes potential and safety performance evaluation of the preliminary scheme was carried out to design speed based on proposed highway classification, forecast traffic, traffic component and terrain along roadside. The design speed difference between two adjacent road sections with different design speed was not to exceed 20km/h. For adjacent road sections which speed difference is more than 20km/h, the transition section was to be arranged, which length shall guarantee the smooth and safe transition along the alignments. Also, relevant traffic facilities shall be arranged to instruct driver to adjust operating speed.

The design speed adopted for the proposed mainline between Asutsuare Junction and Asikuma Junction was 100kph. This is following the prescription for the desirable design speeds for national roads as obtains in the Ghana Road Design Guide (1991).

b) Reason for concern

It is generally accepted that the chosen design speed must relate to the potential/actual driving behaviour as represented by the 85th percentile speed of passenger cars under free flow conditions. This is likely to be higher with only passenger cars, and even more so, if these were to be travelling on the proposed carriageway which lies on a relatively flat terrain.

The design speed is probably the most important geometric design parameter because it is supposed to be applied to obtain a consistent coordinated alignment. Adoption of 100 kph design speed throughout the mainline would very likely result in departure from consistency on the approaches of the proposed intersections where vehicular maneuverabilities at the transition zone will be at its threshold and operating speeds of diverging and merging traffic (leaving/entering the intersections) are likely to be lower than speeds of through traffic. This means that the design speed is at variance with actual driving behaviour (a situation which has the propensity of violating drivers' expectation) and may lead directly to an increase in accident potential.

c) Recommendation

- The design speed difference between the transition zones and the mainline should be kept at 20km/h. This means that a design speed of 80kph should be maintained at the transition zones.

- The transition zone should also to be arranged, which length shall guarantee the smooth and safe transition along the alignments. Also, relevant traffic facilities such as variable message signs (VMS), Intelligent Traffic System (ITS) and roadway delineation should be arranged in the detailed design stage to instruct driver to adjust operating speed. This is essential
- Signalization of the major intersection on the N2 Highway is essential.
- At the detailed design stage, consideration should be given to the provision of advance directional signs (on gantries and in combination with lane selection signs/markings) to inform/direct drivers to select the appropriate lanes at the approaches of the intersection. This will reduce side-swipe accidents
- In the long term an Interchange should be considered at the Asikuma Junction to enhance the smooth and safe transition of vehicles from one mainline to the other.

2.2 Auxiliary lanes at Asikuma Junction, Asutsuare Junction and Volivo Intersections

a) Observation

The storage and taper lengths are too short and inappropriate traffic safety

b) Reason for concern

Drivers will compete for the small auxiliary lanes as they leave/enter the intersections.

Erratic merging and diverging of impatience drivers may lead to traffic crashes.

c) Recommendation

- Consideration should be given to the extension of the auxiliary lanes to cater for the storage and turning movements of all vehicles.

3.0 Ssafety Concerns at Specific Locations

3.1 Toll Plaza

a) Observation

The proposed Toll Plaza is located quite close to the Volta River Bridge and it is sandwiched between the Volta River Bridge (Km 28+685) and the crossing of Juapong-Dufor Adidome feeder road (Km 29+060).

b) Reason for concern

The propensity of vehicles tailing back into and congesting the Volta River Bridge is high, considering the rather short approach lane of Toll Plaza and the significant proportion of Heavy Goods Vehicles that may use the road.

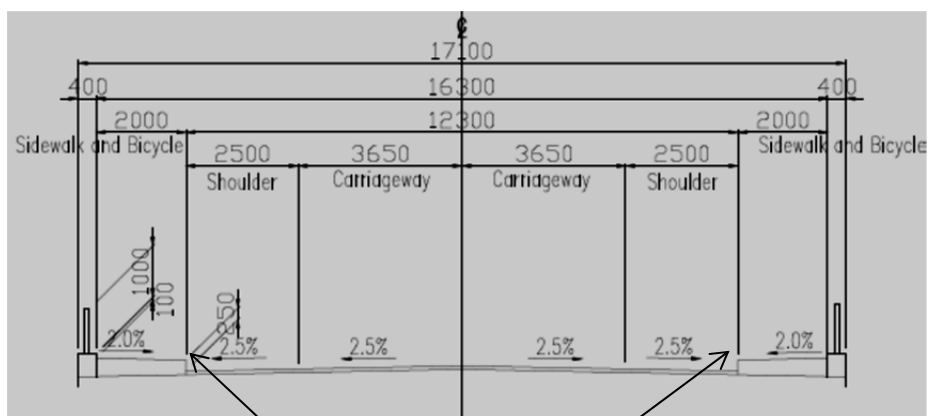
c) Recommendation

- The location of toll booth should be closer to the crossing of Juapong-Dufor Adidome feeder road (Km 29+060) to compensate for adequate space for vehicle approaching the toll both from the Volta River Bridge.
- Consideration should be given to the provision of multiple toll booths and approach lanes to manage the traffic in the vicinity of the Volta River Bridge.

3.2 Cross section of Volta River Bridge

a) Observation

Safety fence has not been provided at the interface of the carriageway and the walkway



No safety fence at the interface of walkway and carriageway

b) Reason for concern

The safety of pedestrian and other vulnerable road users will be impaired as errant motorists cross their path.

c) Recommendation

- Consideration should be given to the provision of appropriate safety fence during the detailed design stage.
- Provision of enhanced road markings and shoulder rumble strips should be considered.